WORKSHOP

Dispercezioni sensoriali

nei Disturbi del Neurosviluppo

Nuoro, 19 Ottobre 2019

Neuroanatomia funzionale dei processi percettivi

Giuseppe Neri Neurologo e Psichiatra

Past-President SNO , Società Neurologi Ospedalieri


LO STRUMENTO UTILIZZATO DALLA SPECIE SAPIENS PER LA RILEVAZIONE, INDIVIDUAZIONE , ELABORAZIONE , MEMORIZZAZIONE E IL RICHIAMO DEI SEGNALI PROVENIENTI DALL'AMBIENTE CIRCOSTANTE
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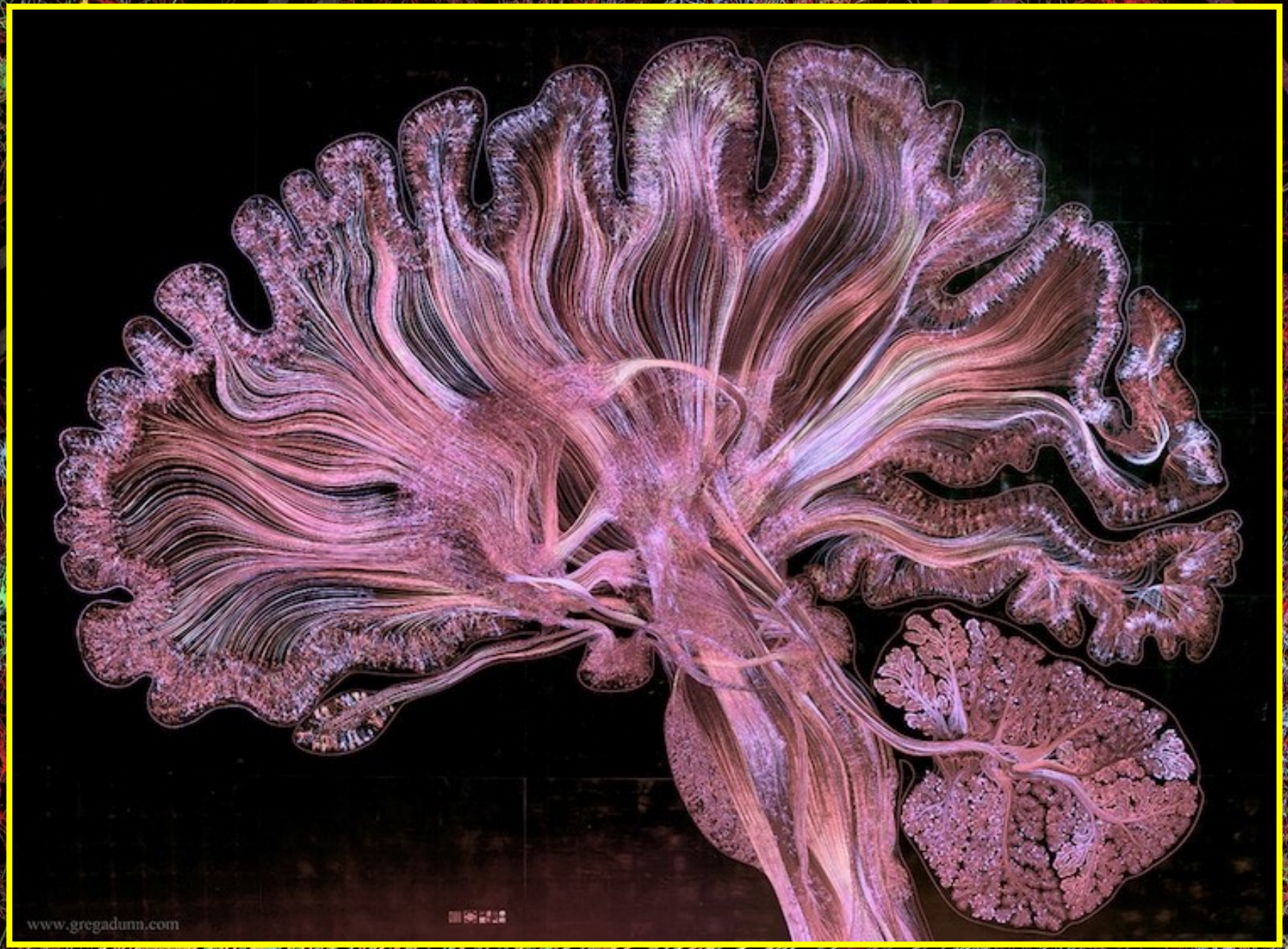
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Camillo GOLGI

Pregalo hecho por el Dr Cajal

SULLA FINA STRUTTURA

DEI

BULBI OLFATTORII

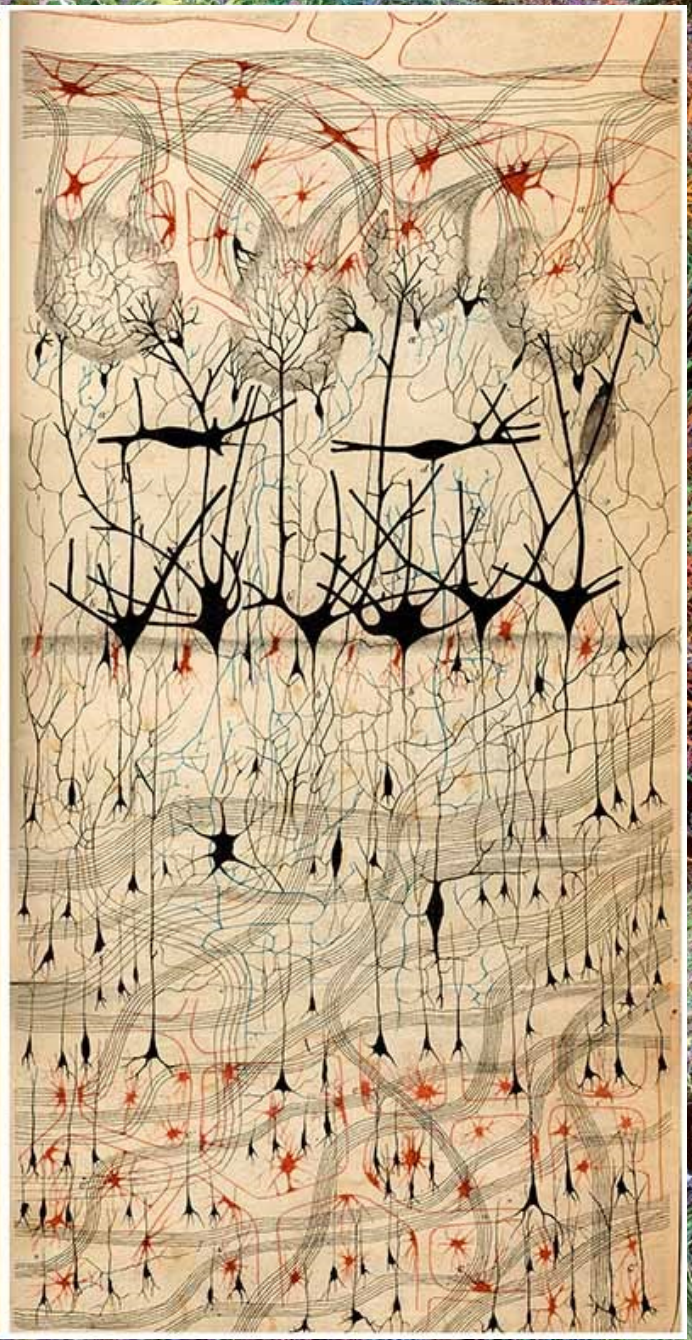
RICERCHE

DEL

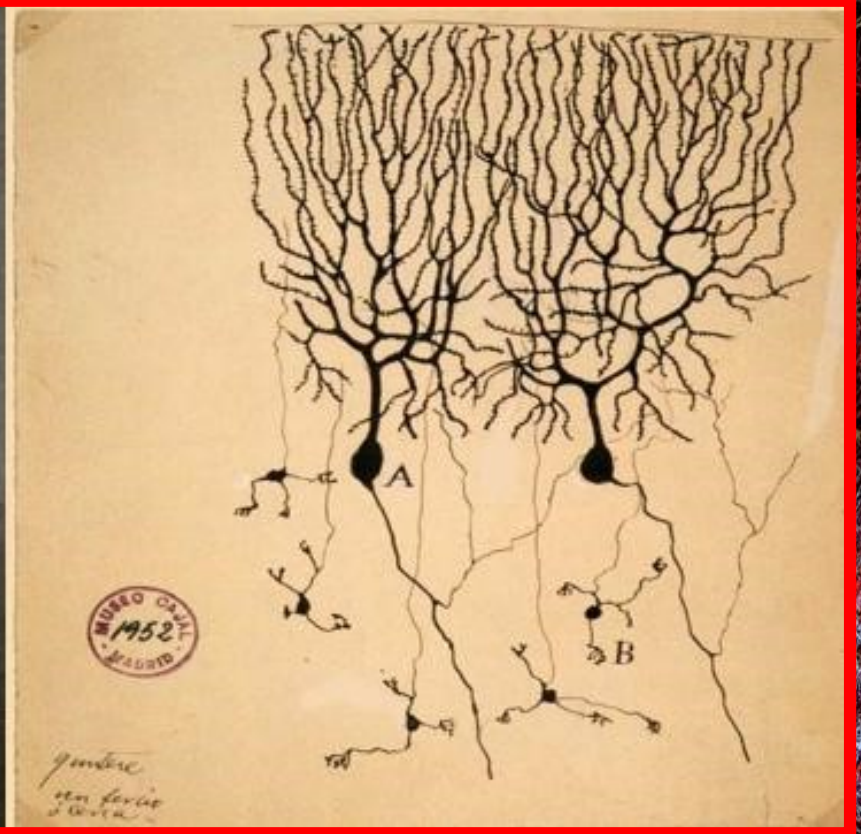
DOTT. CAMILLO GOLGI

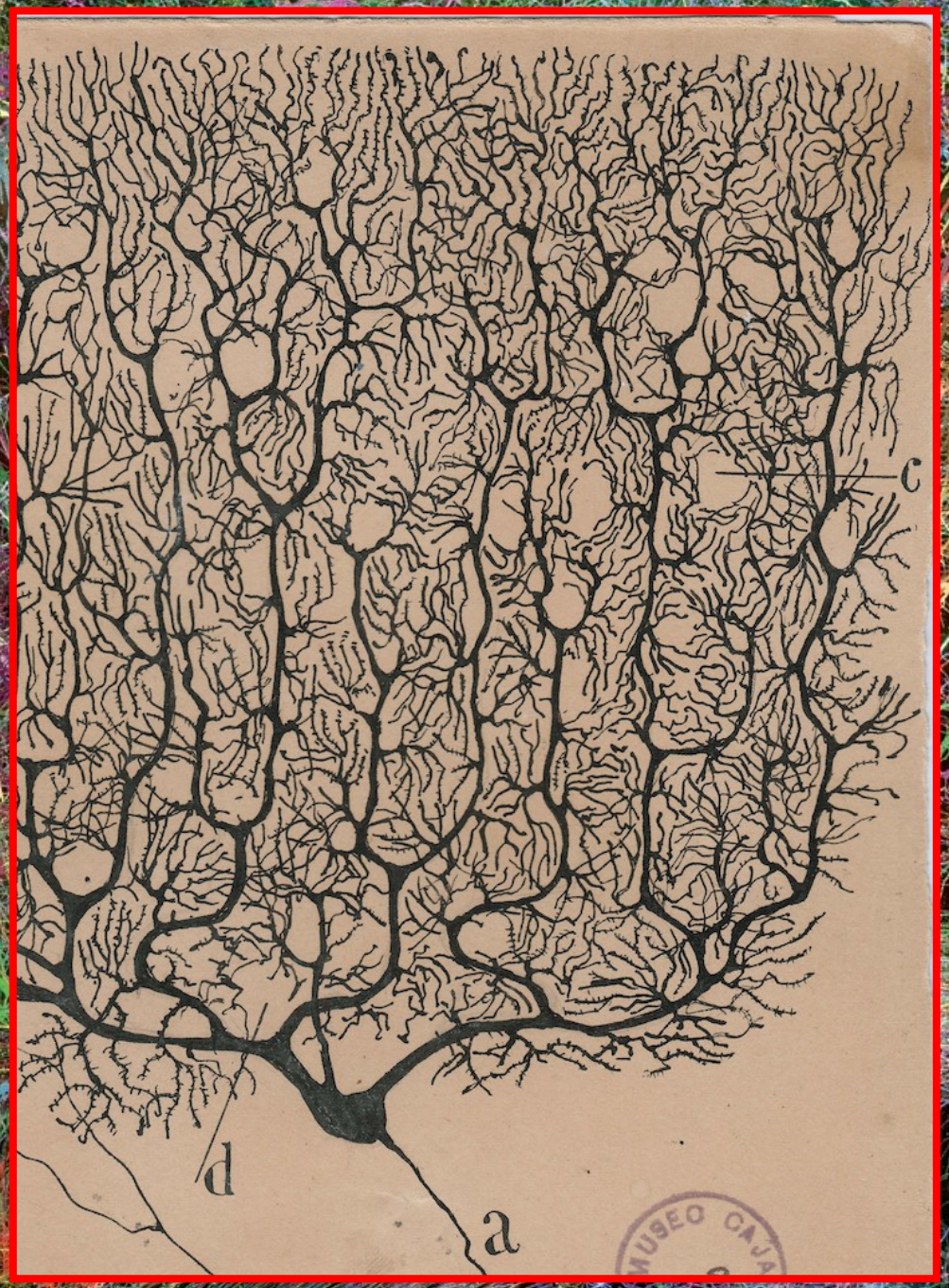
(Con una tavola litog.)

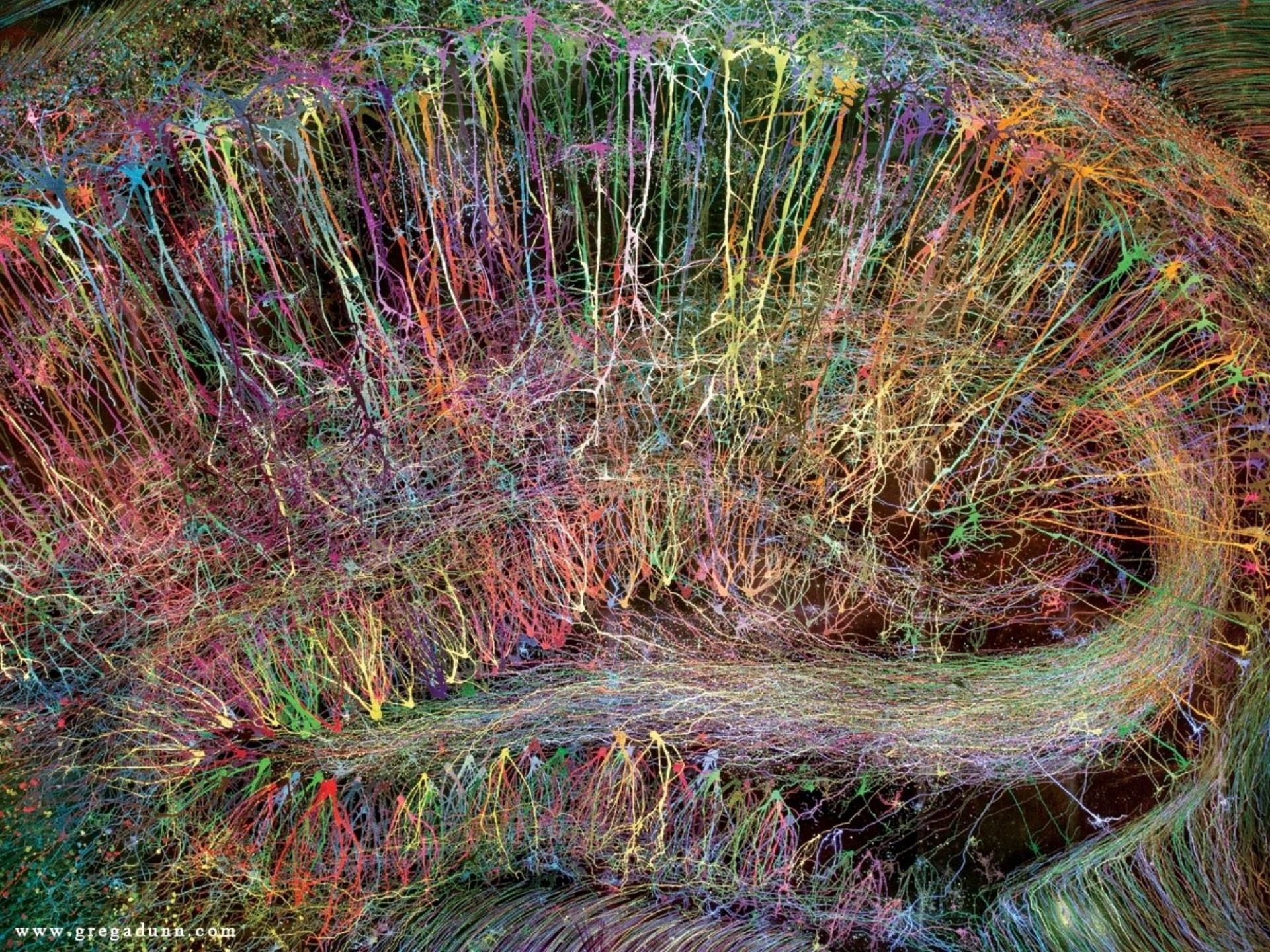
REGGIO-EMILIA
TIPOGRAFIA DI STEFANO CALDERINI
1875.



SANTIAGO RAMON Y CAJAL



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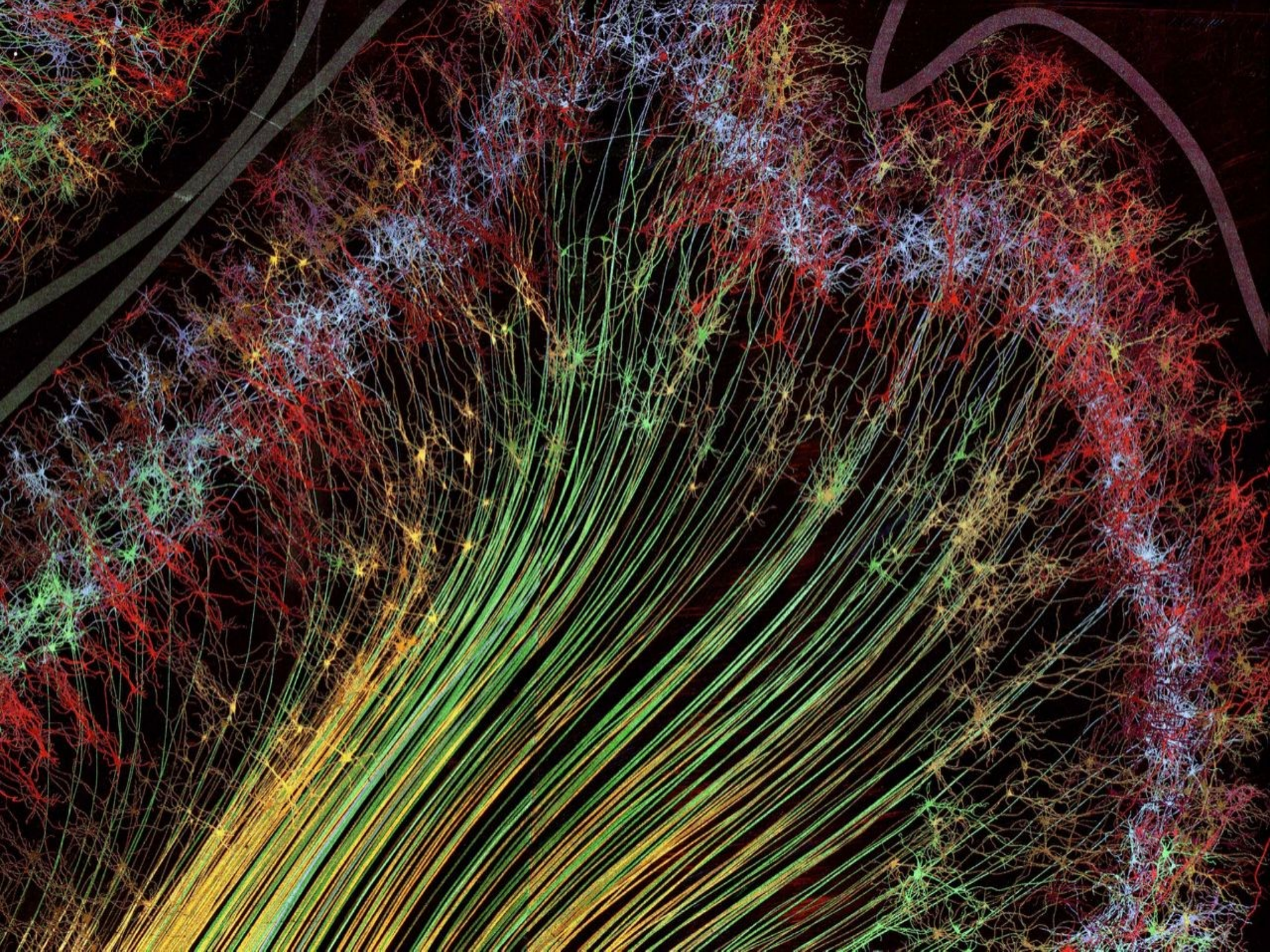
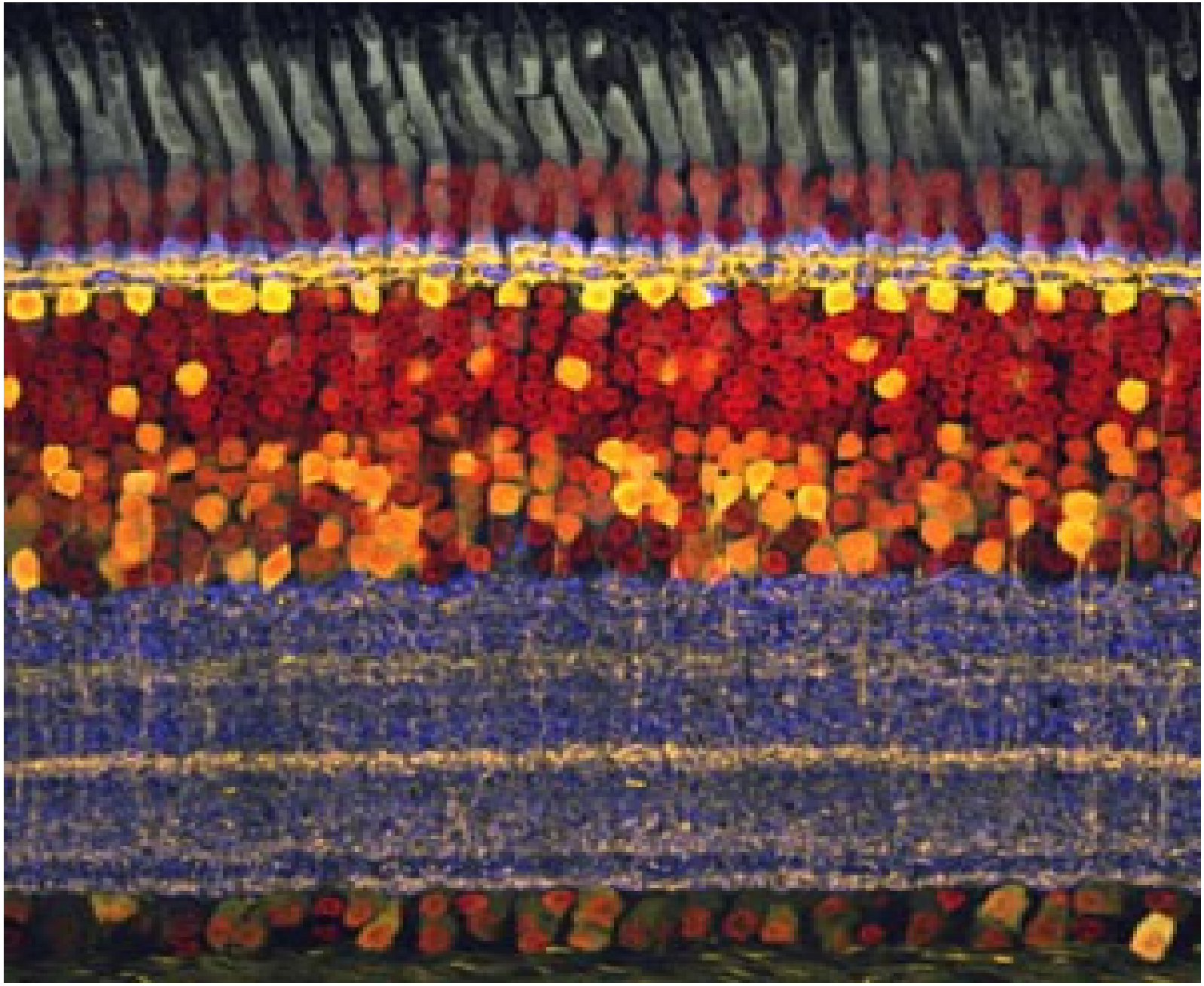
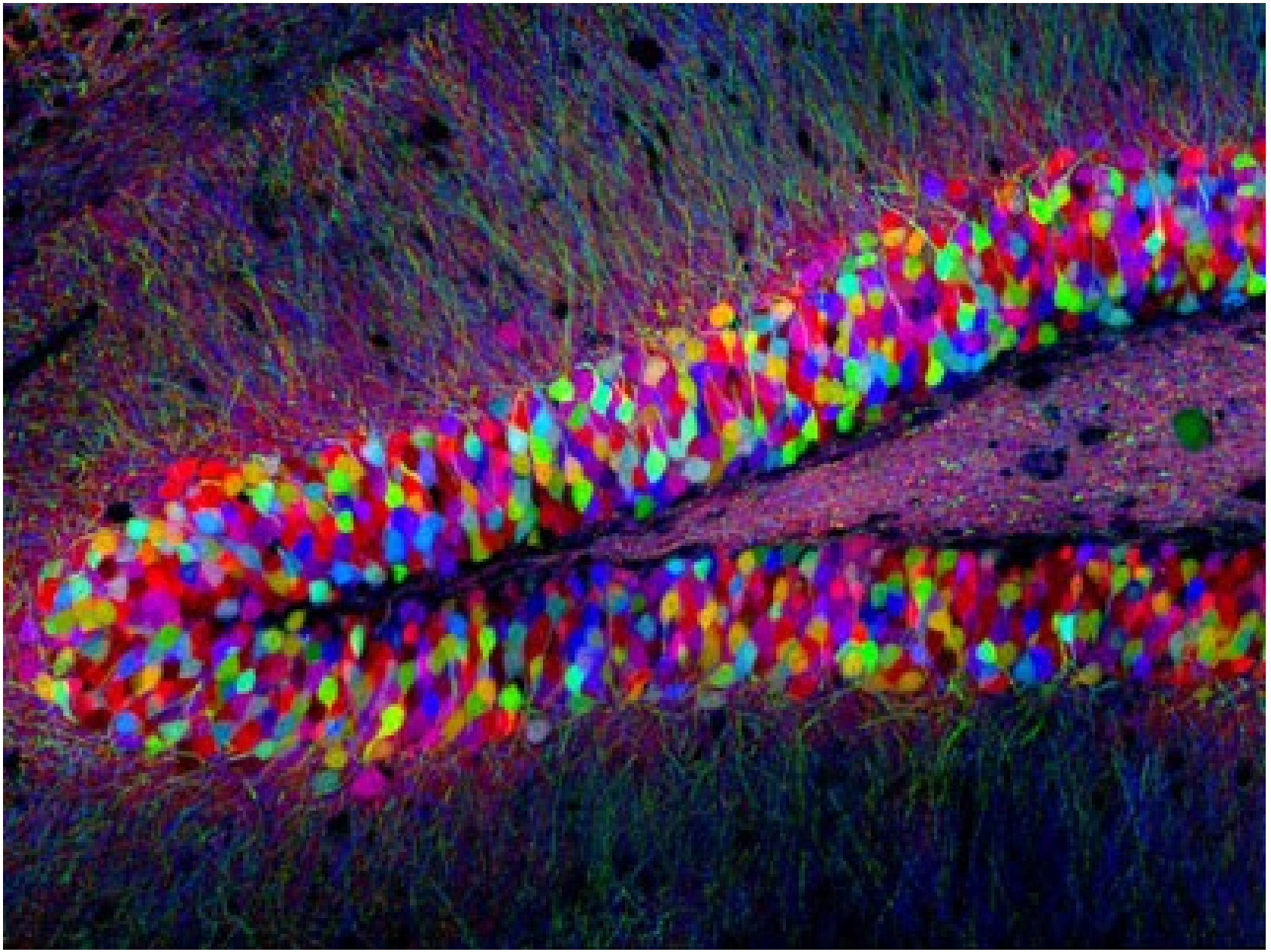
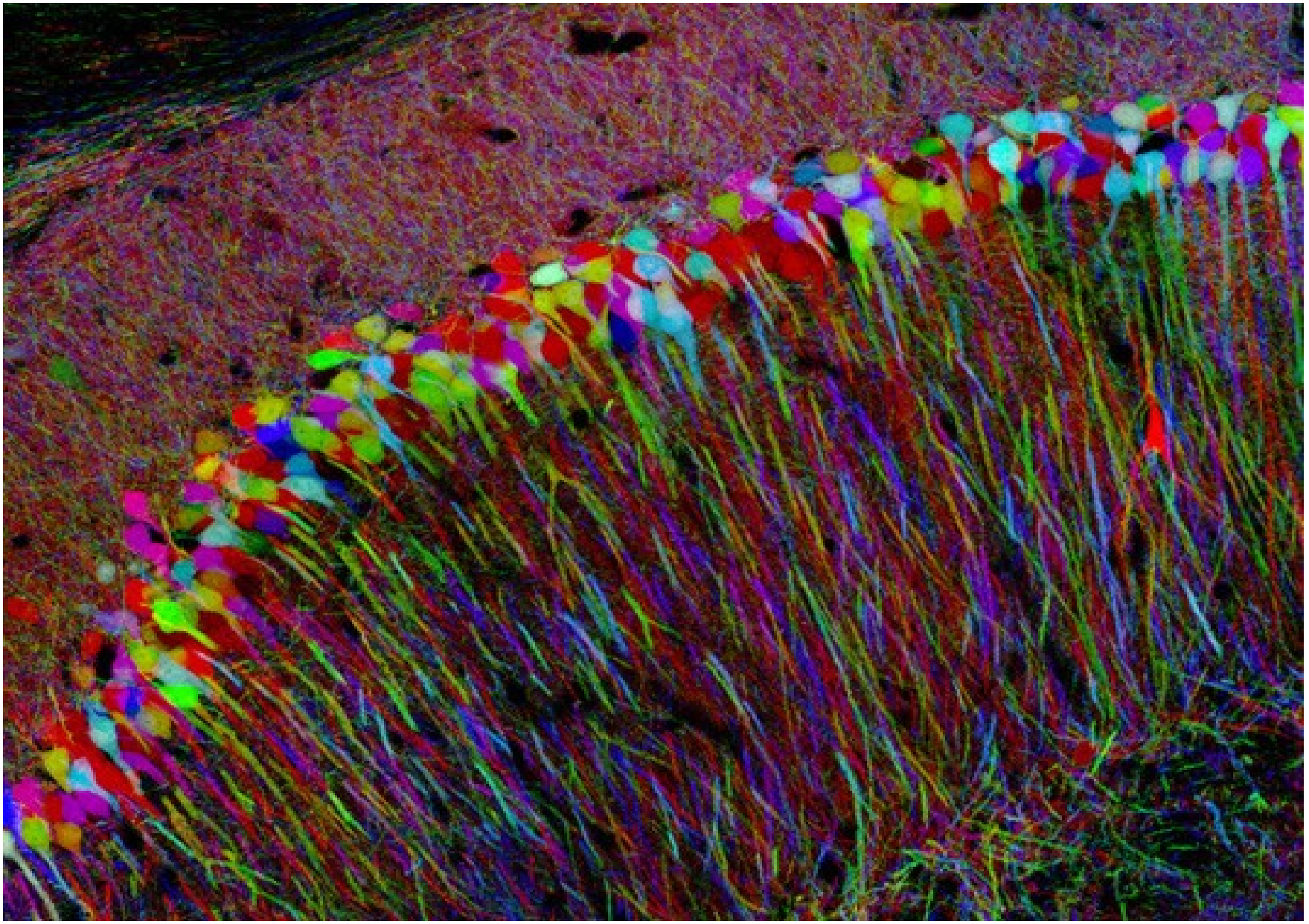
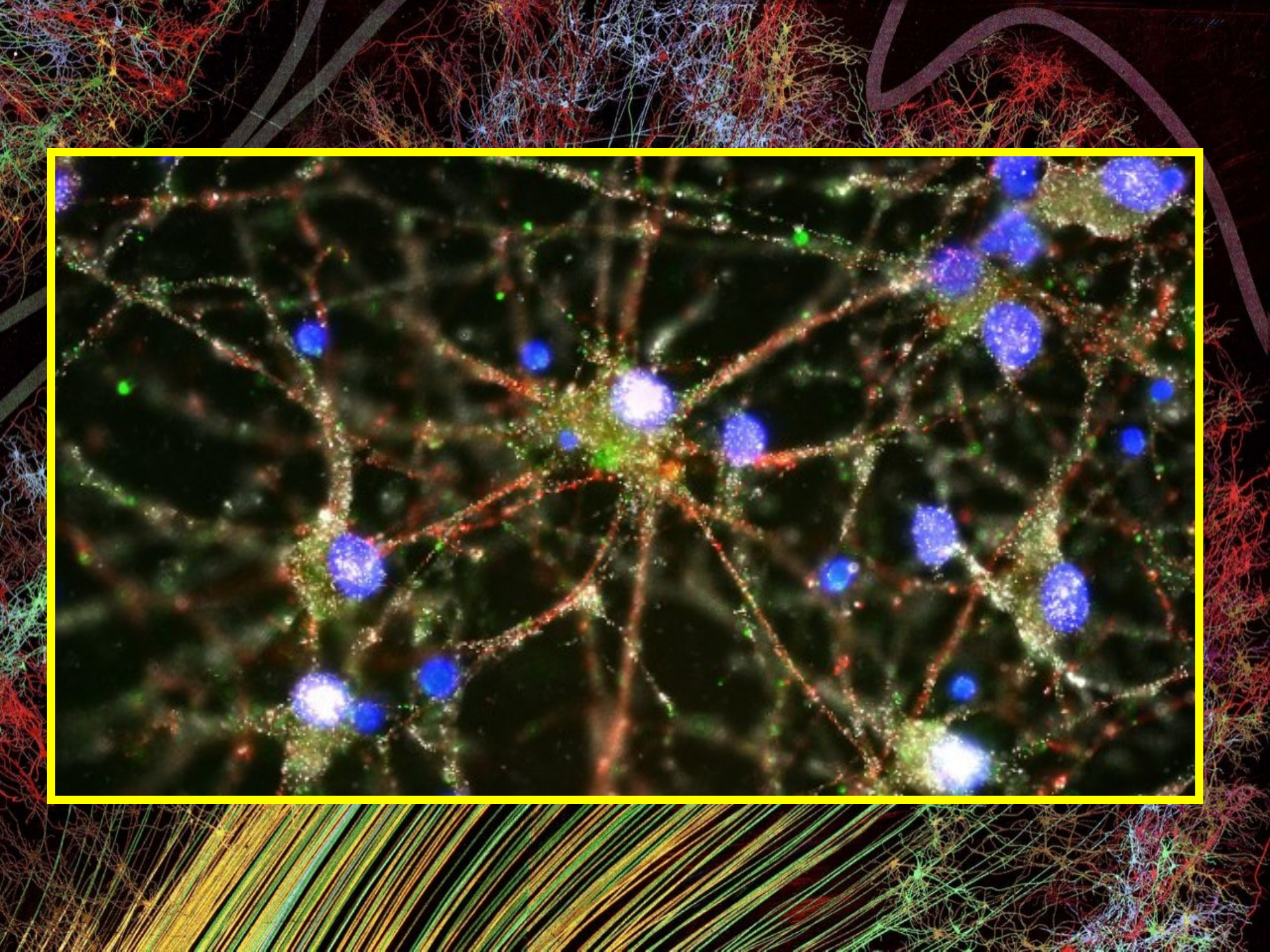
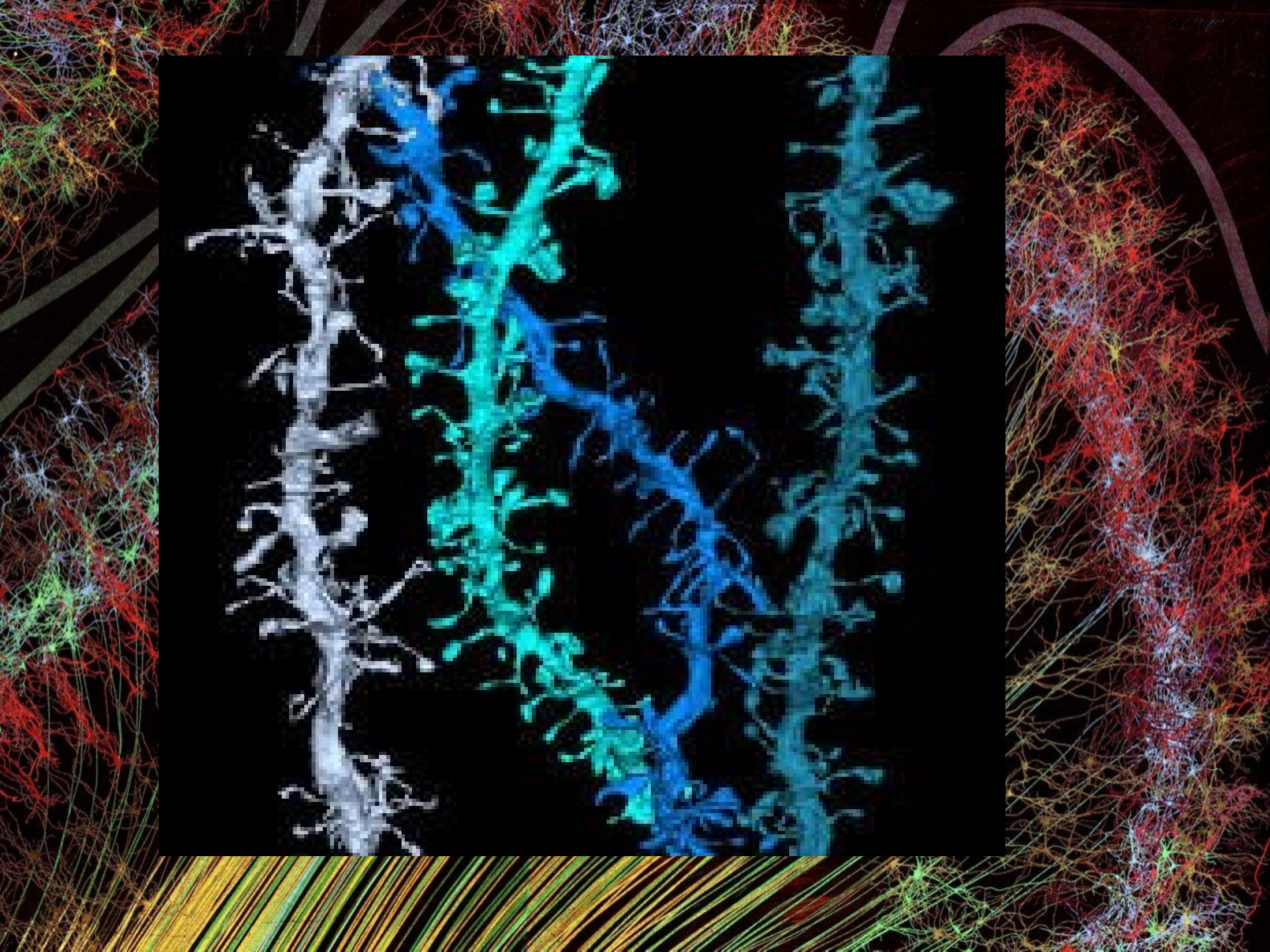




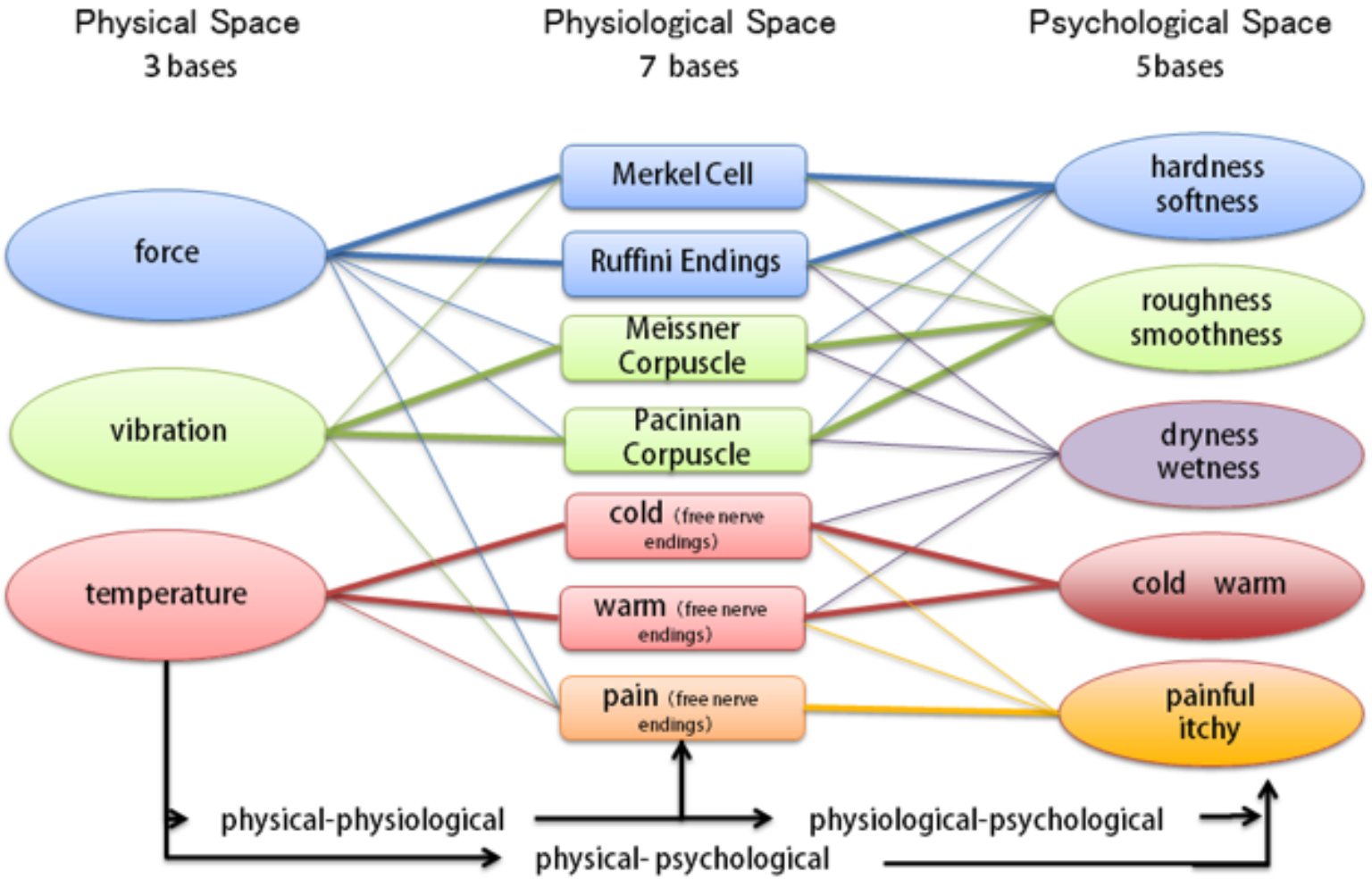




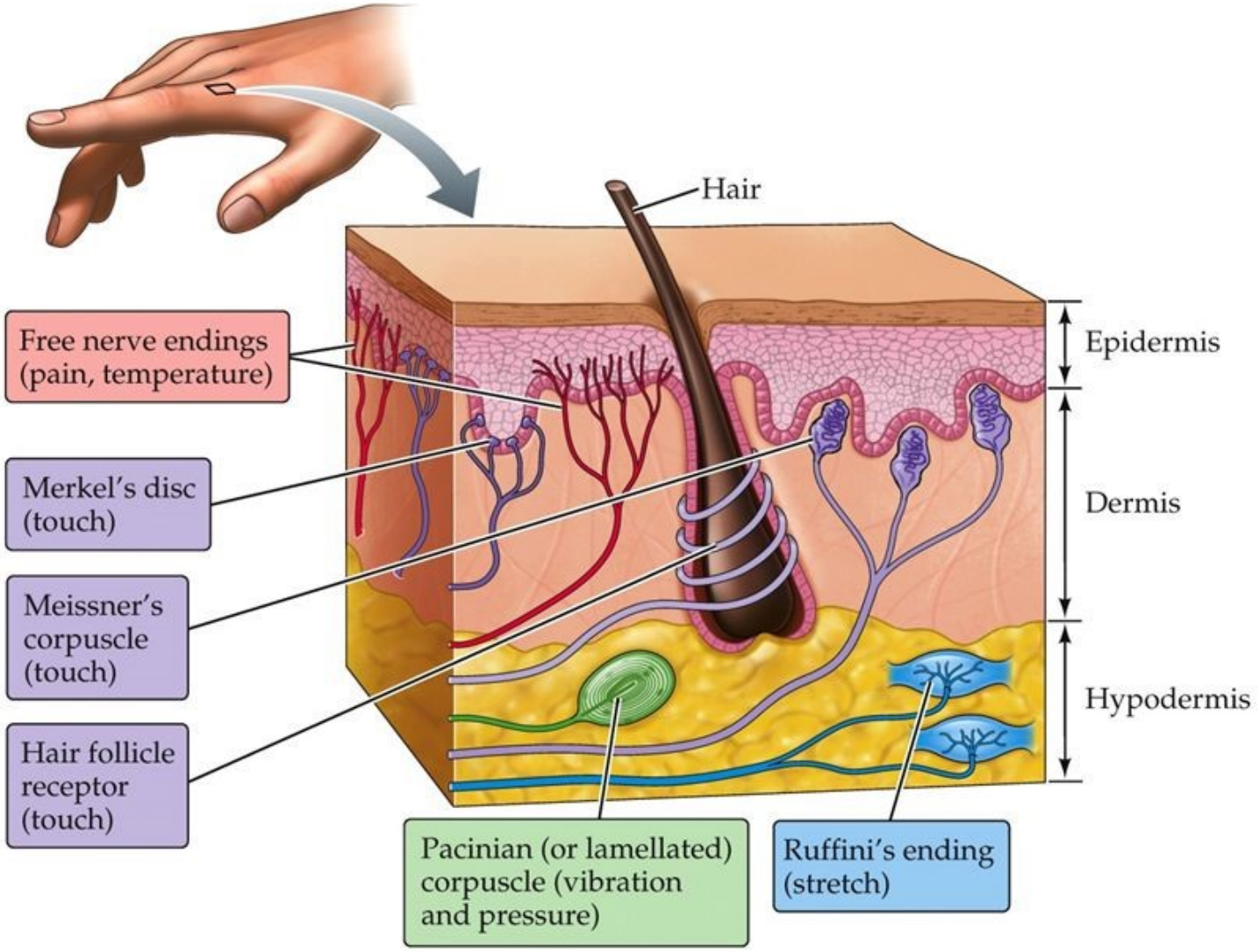




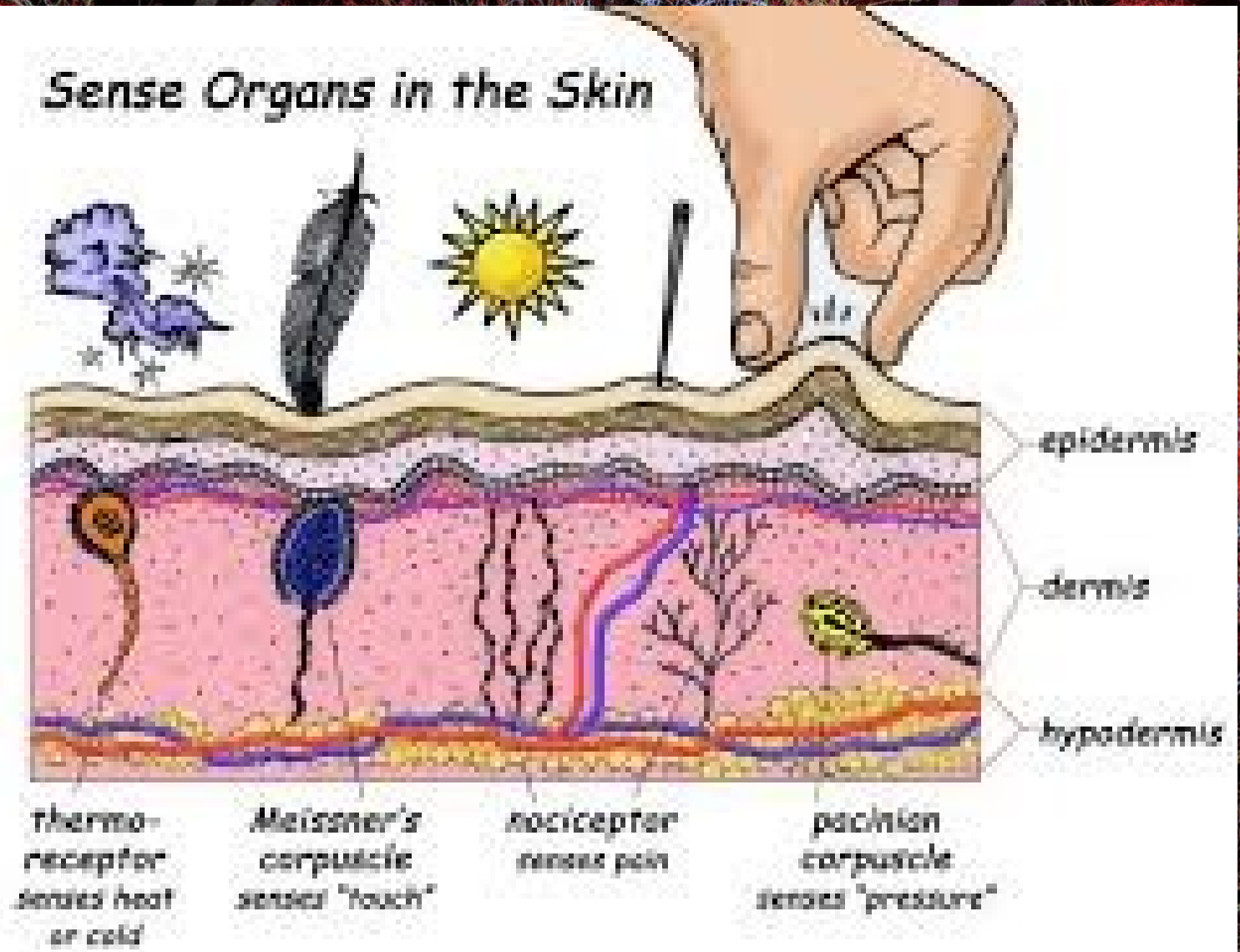
SENSAZIONE : attivazione dei sistemi recettoriali rivolti al mondo esterno in relazione alla presenza di uno stimolo specifico.
PERCEZIONE è la elaborazione, a cura dei sistemi complessi del Sitema Nervoso Centrale, degli stimoli sensitivi con la attribuzione di significati selettivi e specifici.

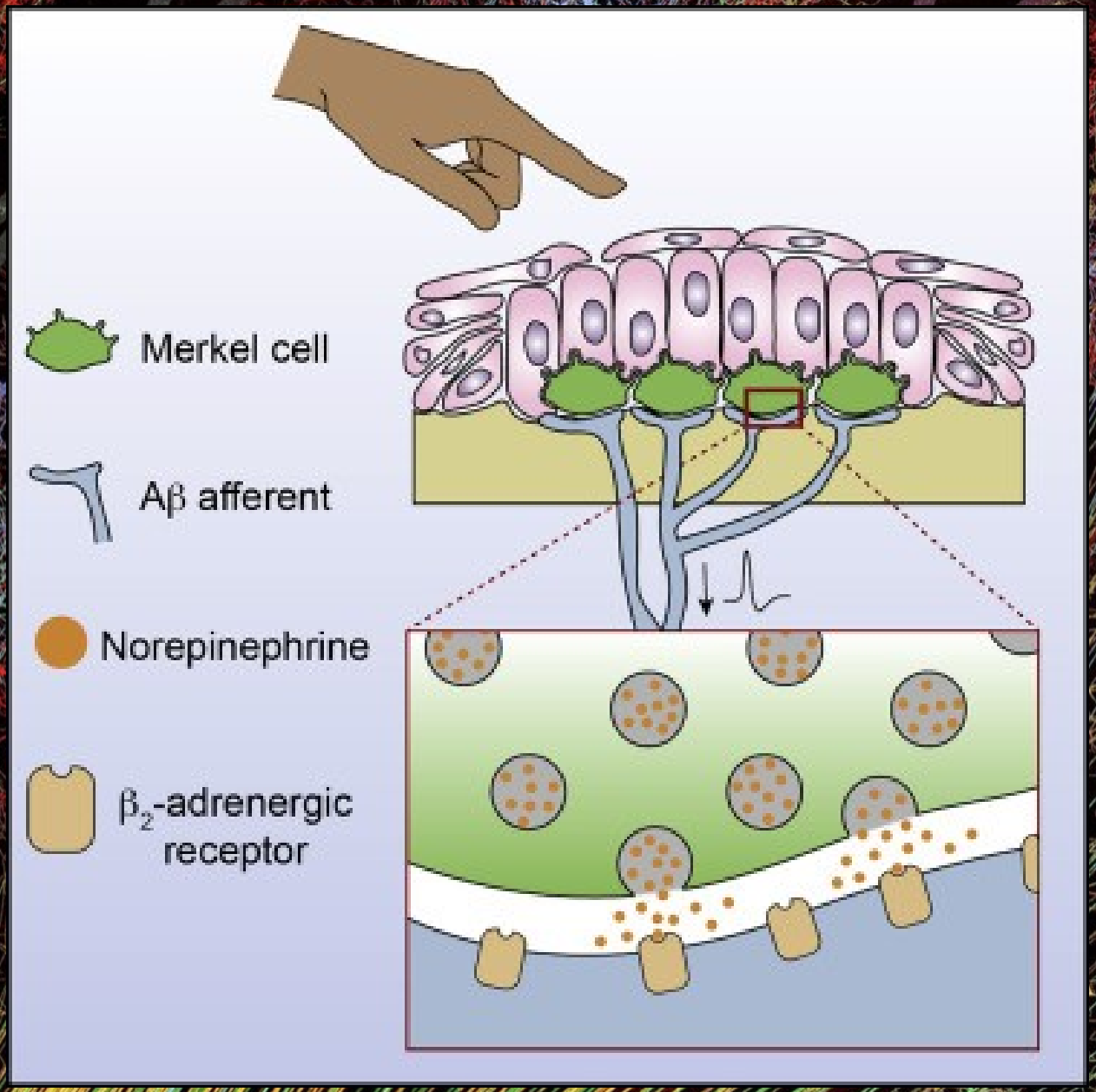


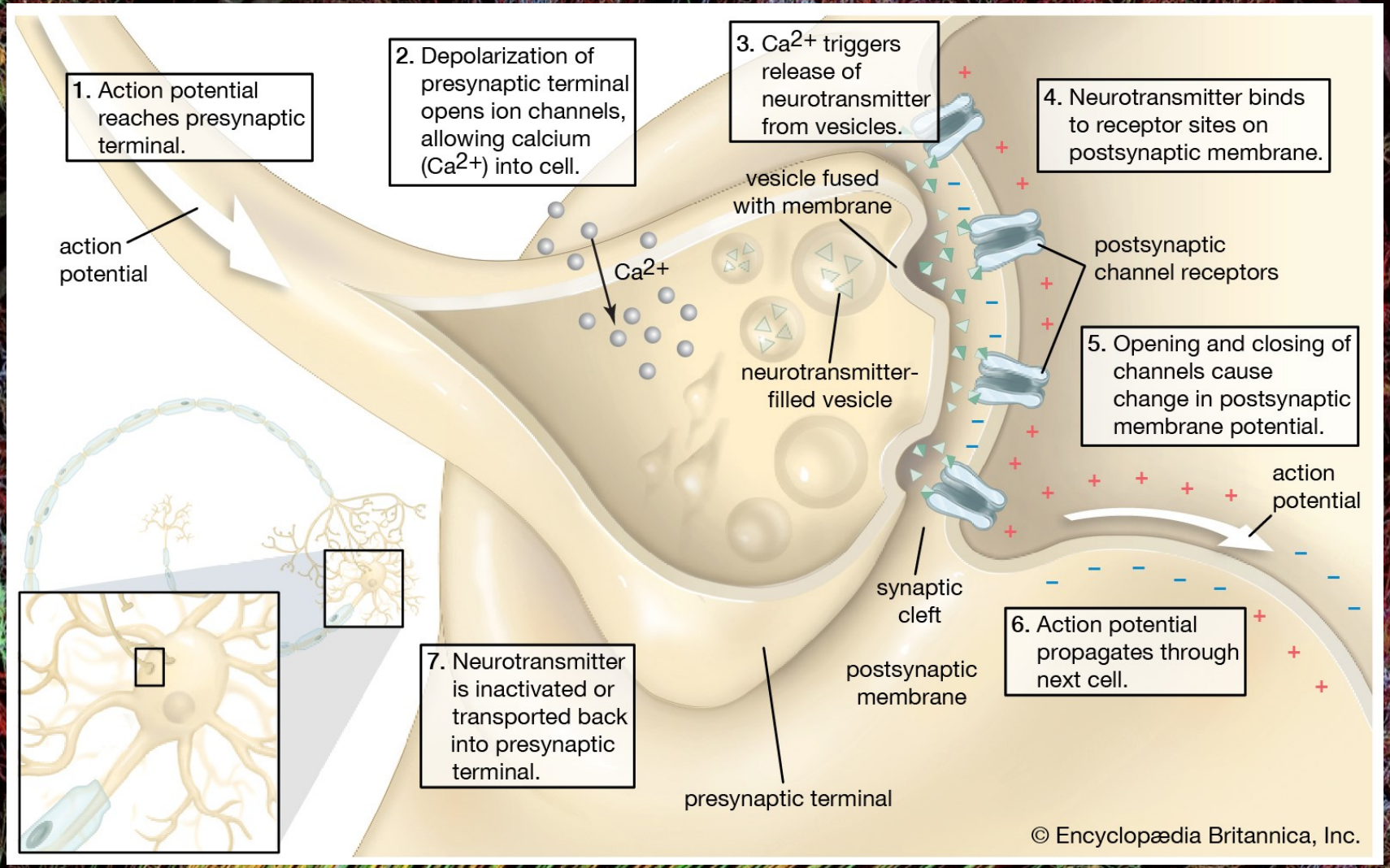
Receptors in Skin



***BIOLOGICAL PSYCHOLOGY 7e*, Figure 8.4**


Sense Organs in the Skin
epidermis
dermis
hypodermis
thermo-receptor senses heat or cold
Meissner's corpuscle senses "touch"
nocicepter senses pain
pacinian corpuscle senses "pressure"


Merkel cell
Aβ afferent
Norepinephrine
β2-adrenergic receptor


1. Action potential reaches presynaptic terminal.
2. Depolarization of presynaptic terminal opens ion channels, allowing calcium (Ca^{2+}) into cell.
3. Ca^{2+} triggers release of neurotransmitter from vesicles.
4. Neurotransmitter binds to receptor sites on postsynaptic membrane.
5. Opening and closing of channels cause change in postsynaptic membrane potential.
6. Action potential propagates through next cell.
7. Neurotransmitter is inactivated or transported back into presynaptic terminal.
action potential
Ca^{2+}
vesicle fused with membrane
neurotransmitter-filled vesicle
postsynaptic channel receptors
action potential
synaptic cleft
postsynaptic membrane
presynaptic terminal
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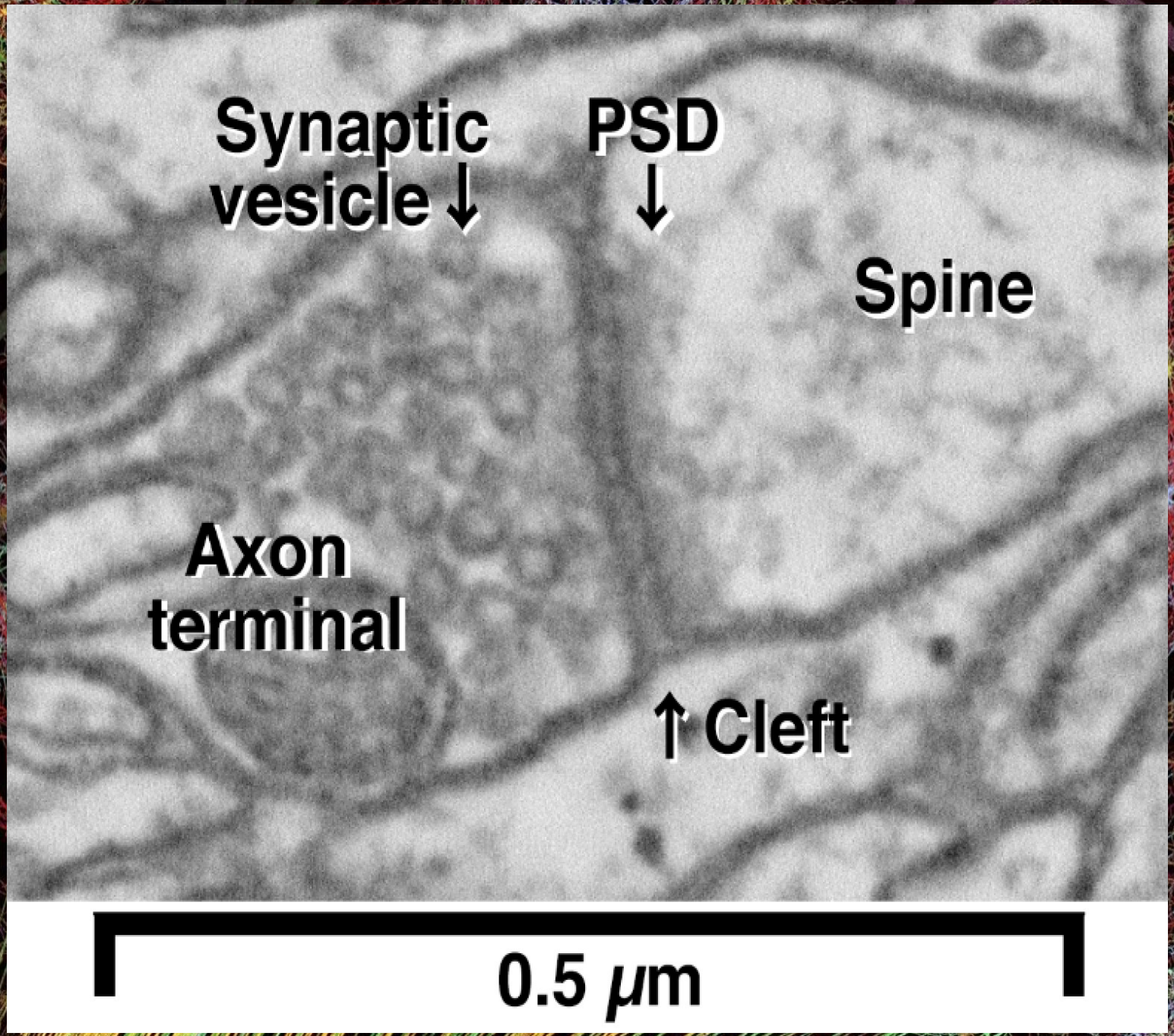
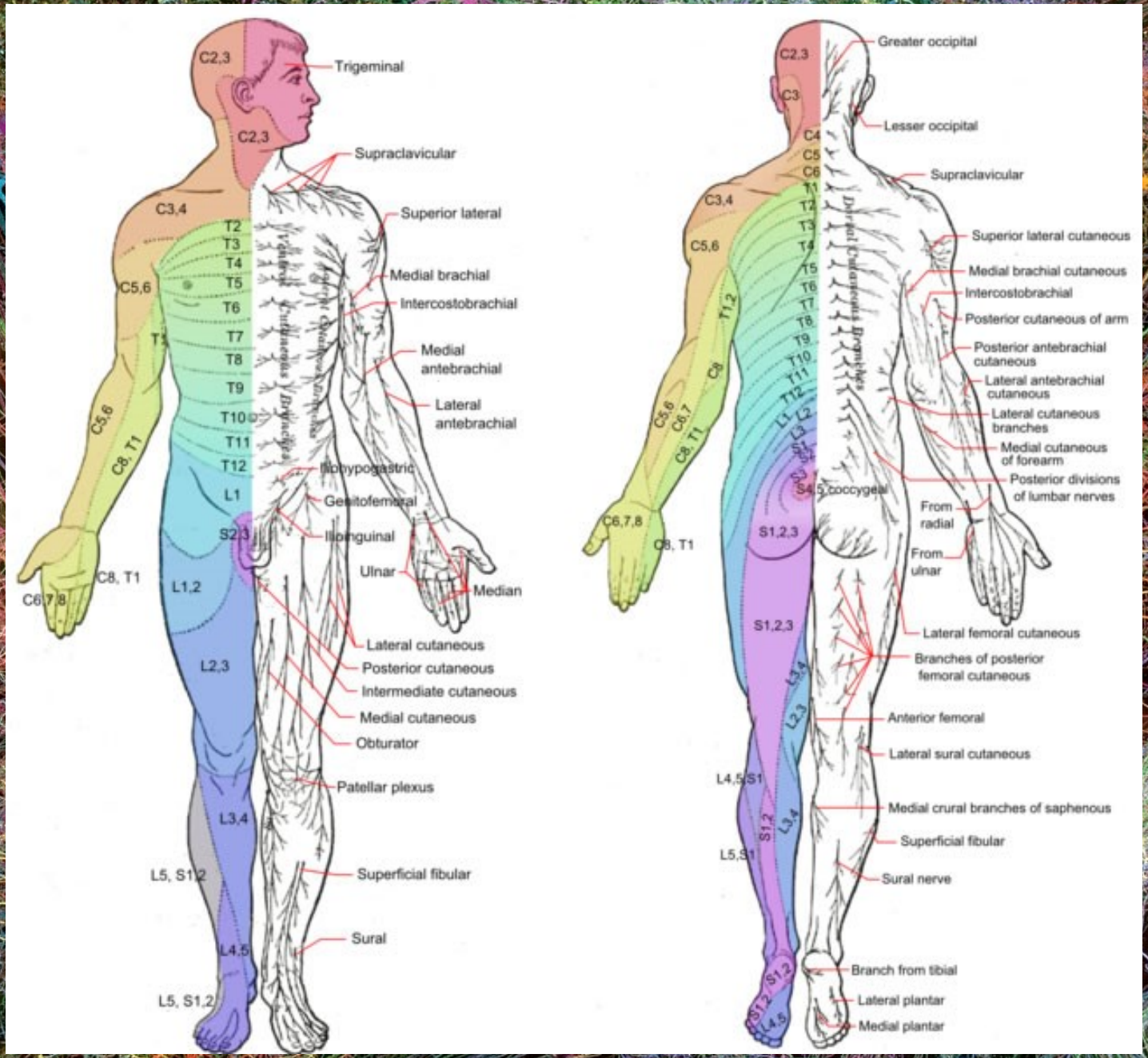
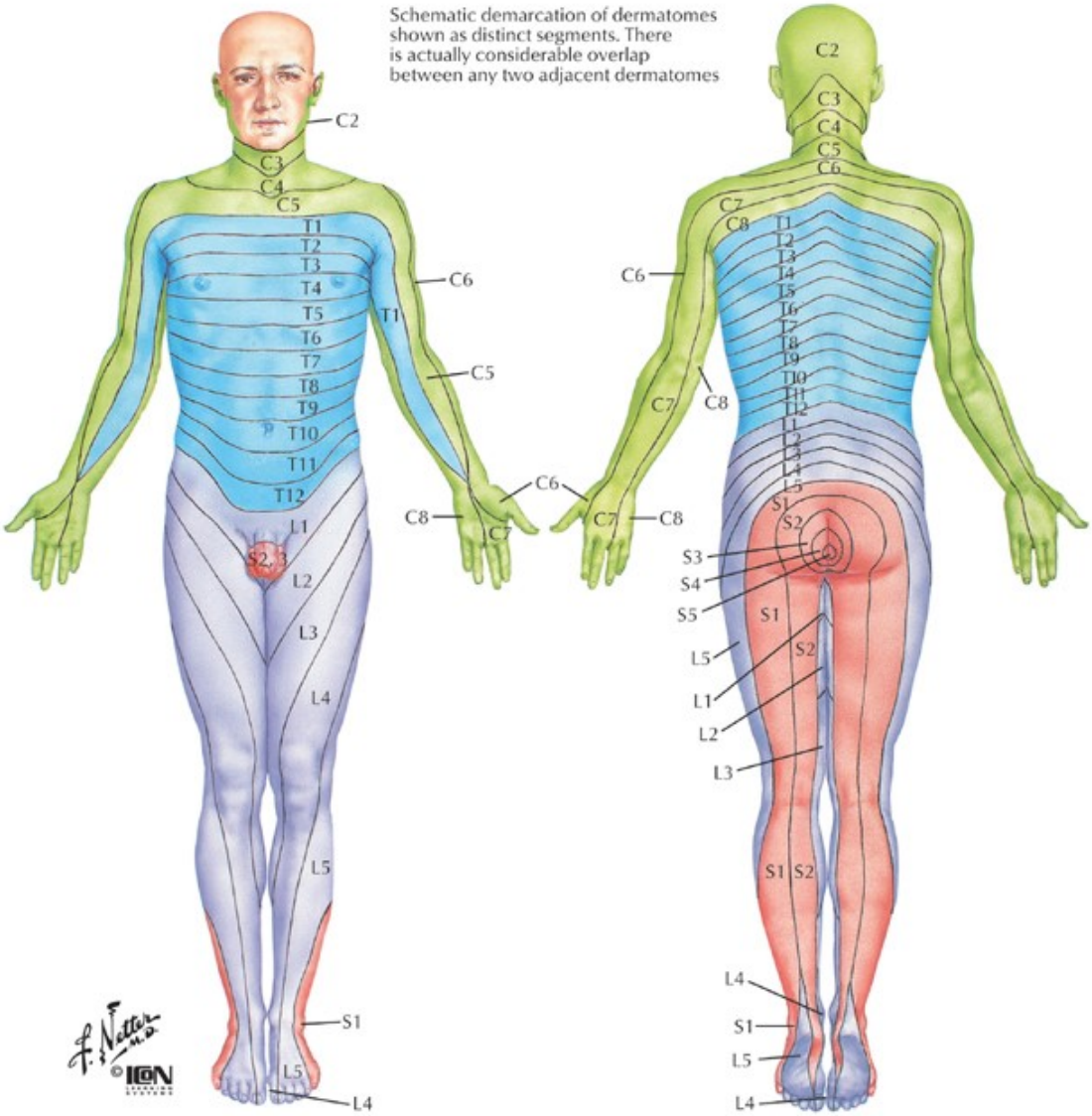

Synaptic vesicle
PSD
Spine
Axon terminal
Cleft
0.5 μm



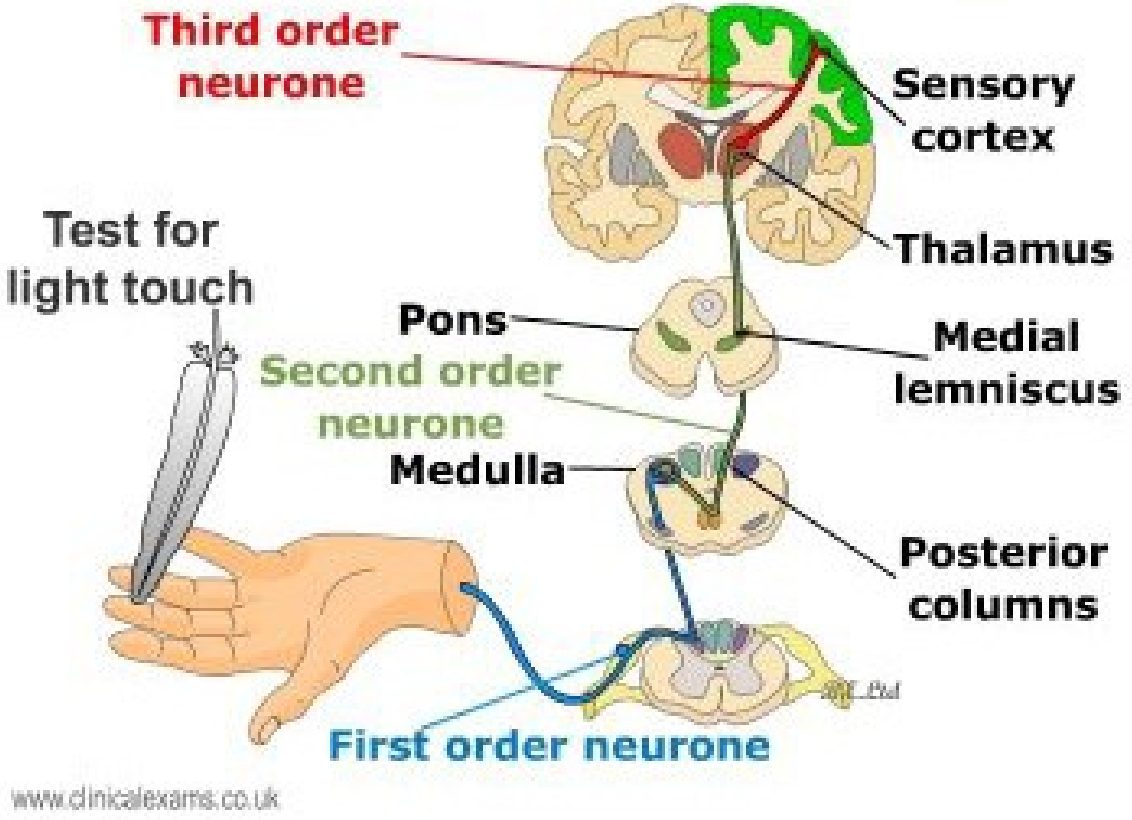
Schematic demarcation of dermatomes shown as distinct segments. There is actually considerable overlap between any two adjacent dermatomes

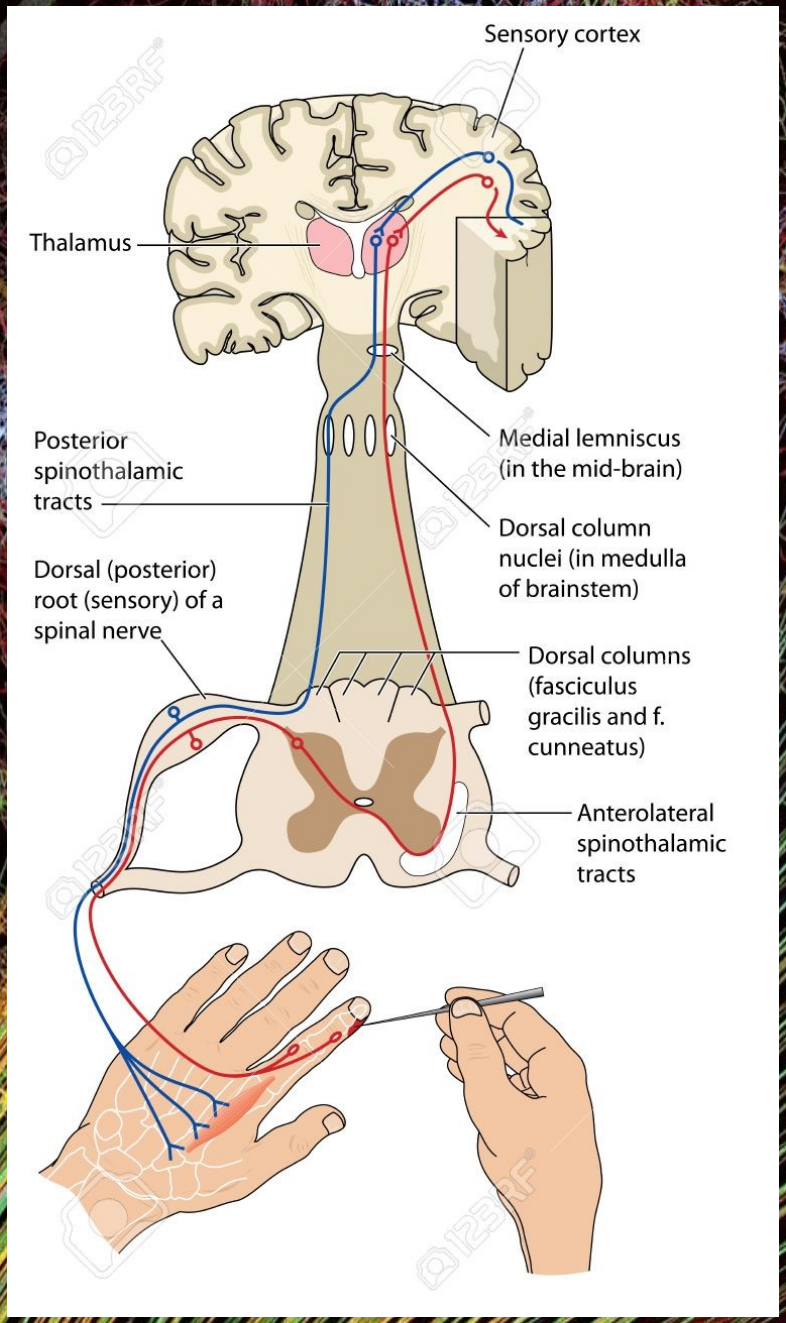


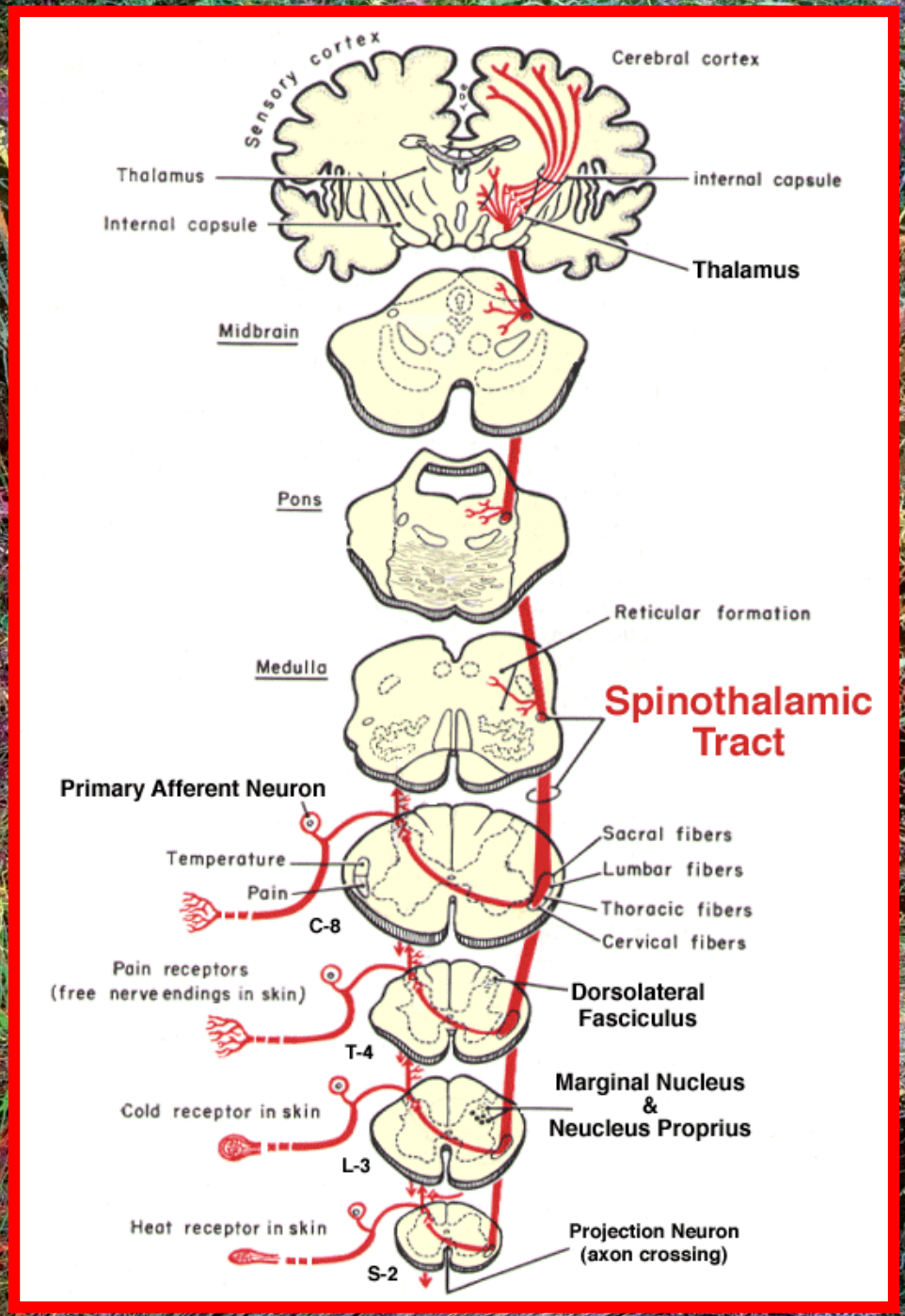
Levels of principal dermatomes

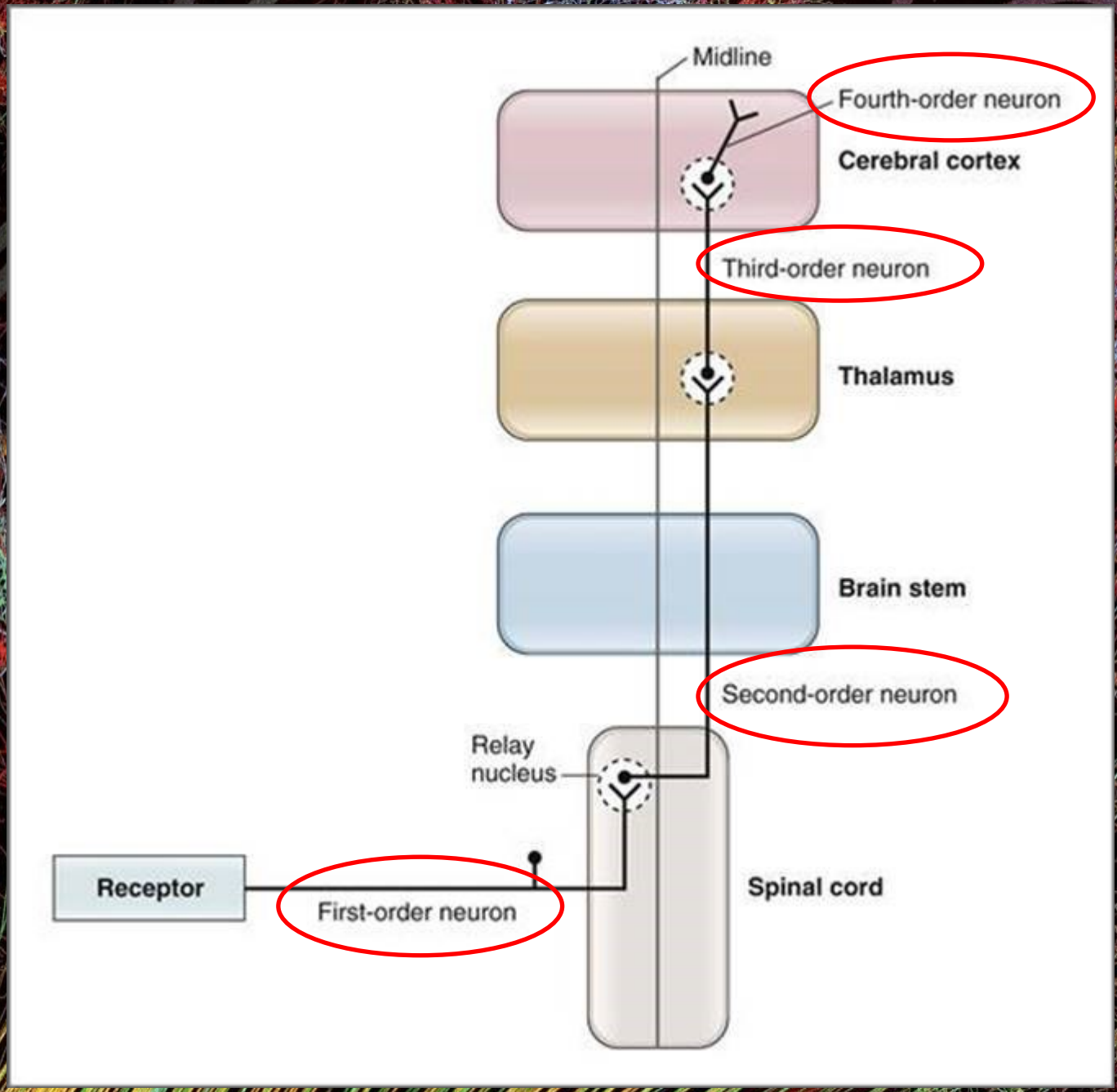
C5	Clavicles
C5, 6, 7	Lateral parts of upper limbs
C8, T1	Medial sides of upper limbs
C6	Thumb
C6, 7, 8	Hand
C8	Ring and little fingers
T4	Level of nipples
T10	Level of umbilicus
T12	Inguinal or groin regions
L1, 2, 3, 4	Anterior and inner surfaces of lower limbs
L4, 5, S1	Foot
L4	Medial side of great toe
S1, 2, L5	Posterior and outer surfaces of lower limbs
S1	Lateral margin of foot and little toe
S2, 3, 4	Perineum

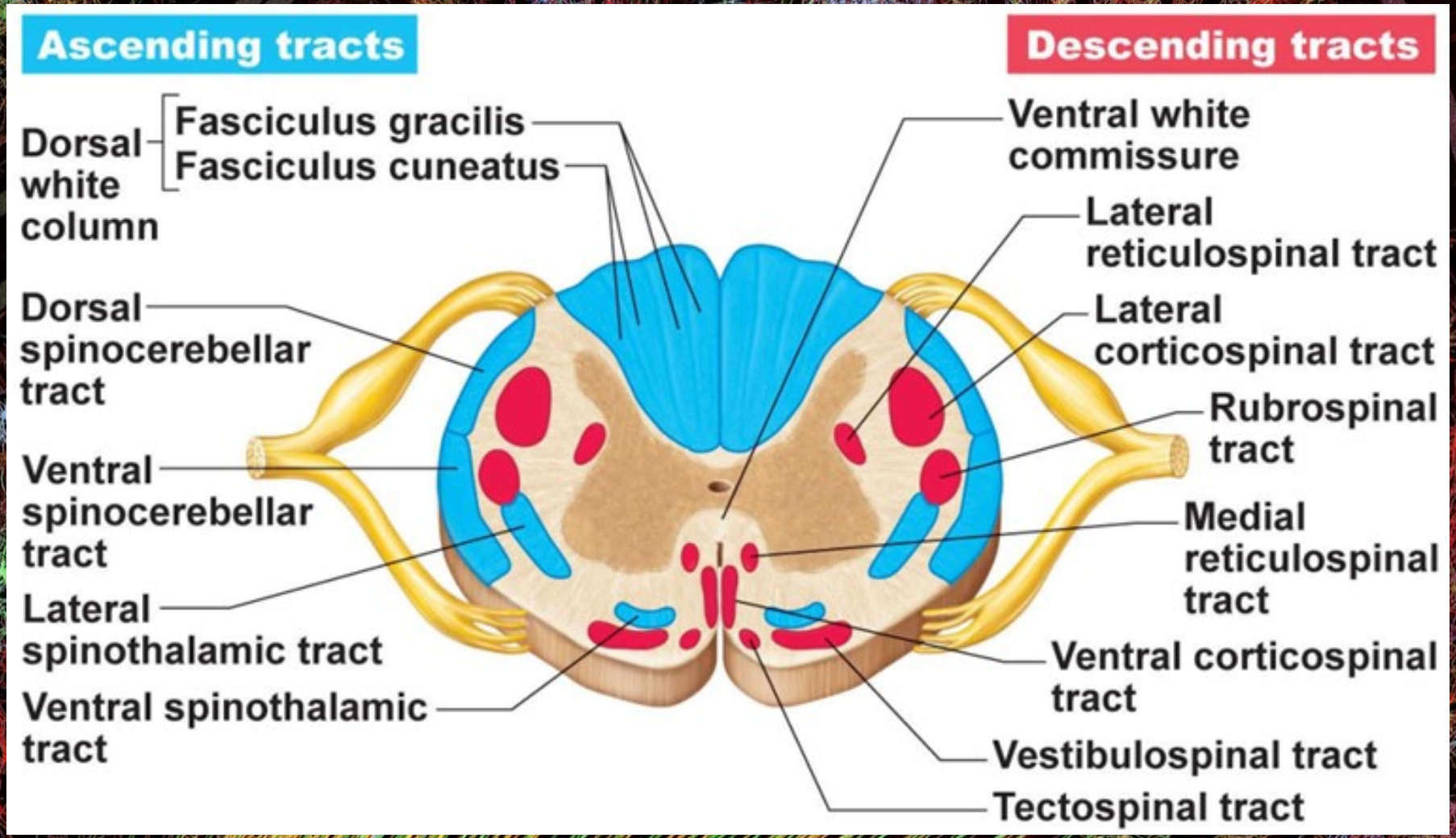
Posterior column-medial lemniscus pathway




Sensory cortex
Thalamus
Posterior spinothalamic tracts
Medial lemniscus (in the mid-brain)
Dorsal column nuclei (in medulla of brainstem)
Dorsal (posterior) root (sensory) of a spinal nerve
Dorsal columns (fasciculus gracilis and f. cunneatus)
Anterolateral spinothalamic tracts




Midline
Fourth-order neuron
Cerebral cortex
Third-order neuron
Thalamus
Brain stem
Second-order neuron
Relay nucleus
Receptor
First-order neuron
Spinal cord


Ascending tracts
Descending tracts
Dorsal white column
Fasciculus gracilis
Fasciculus cuneatus
Dorsal spinocerebellar tract
Ventral spinocerebellar tract
Lateral spinothalamic tract
Ventral spinothalamic tract
Ventral white commissure
Lateral reticulospinal tract
Lateral corticospinal tract
Rubrospinal tract
Medial reticulospinal tract
Ventral corticospinal tract
Vestibulospinal tract
Tectospinal tract

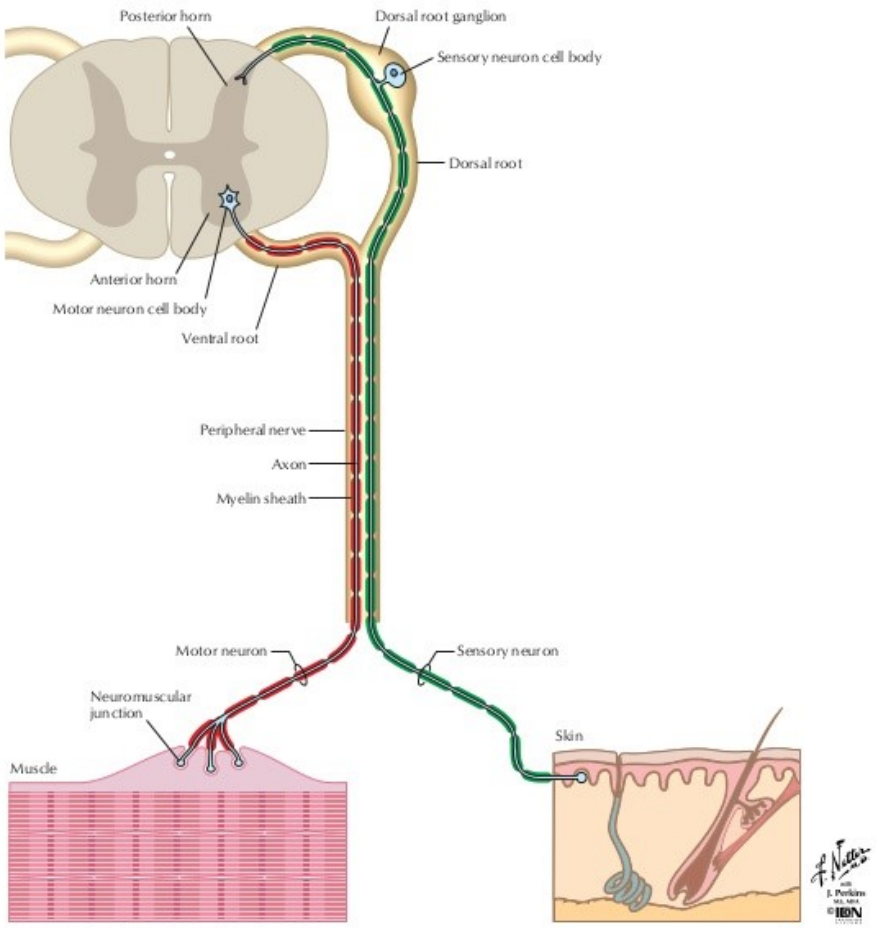
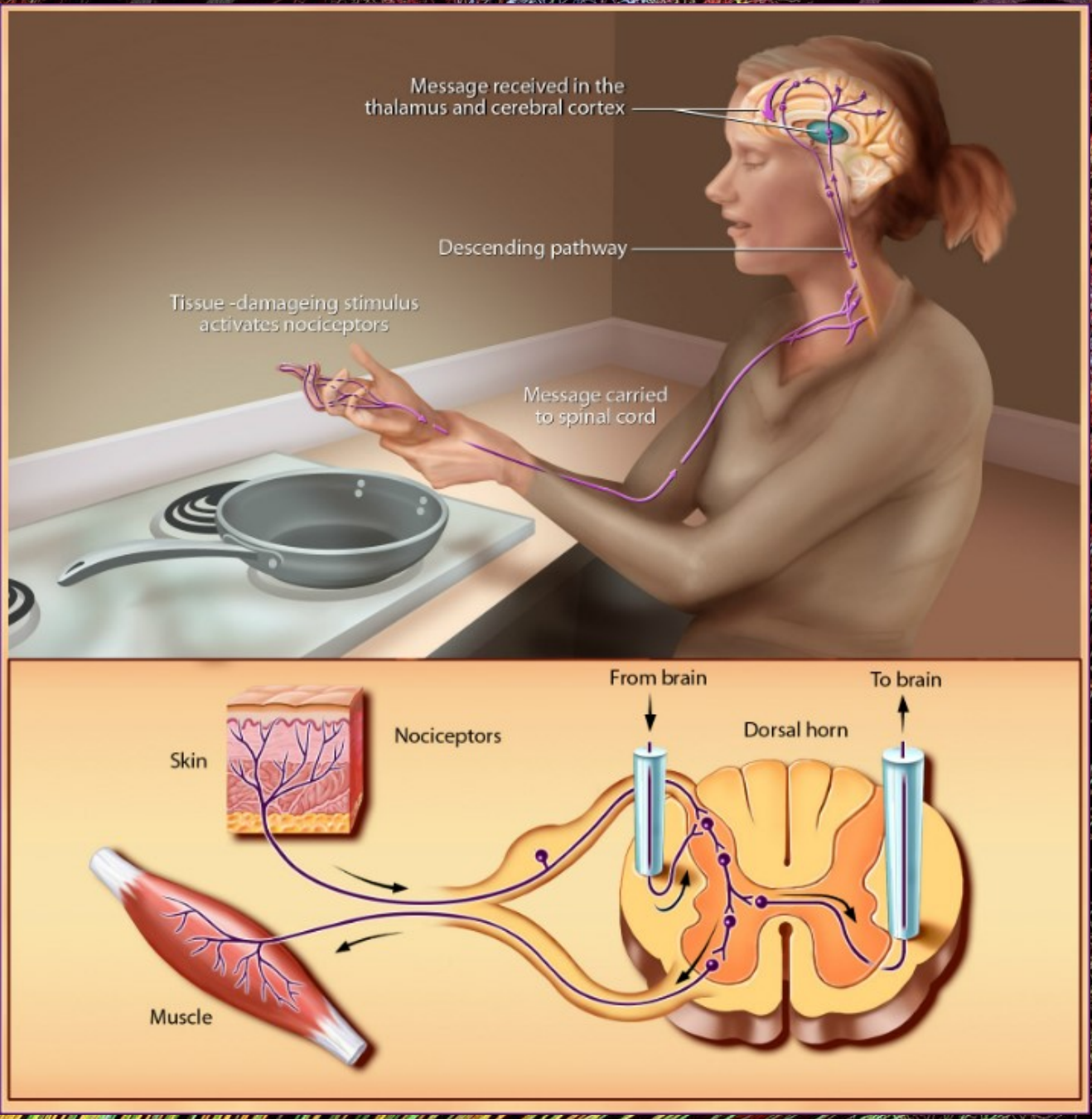
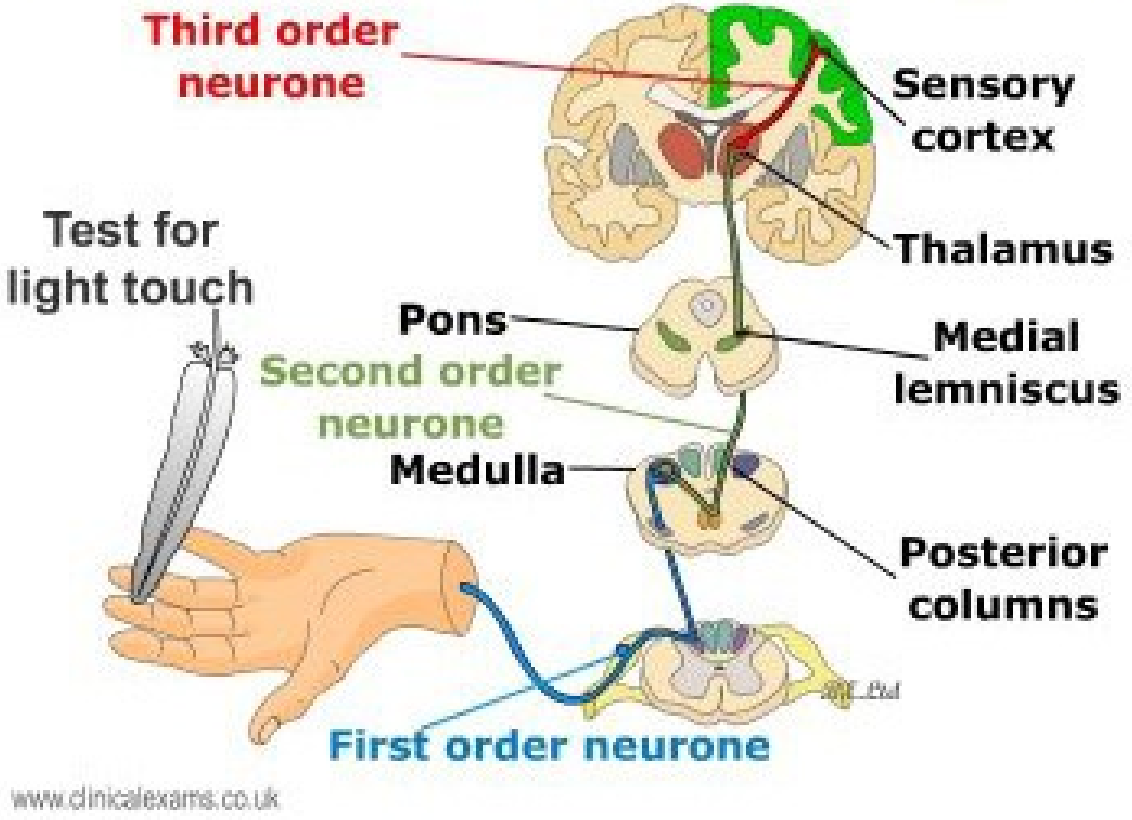


FIGURE 2.14 PERIPHERAL NERVOUS SYSTEM

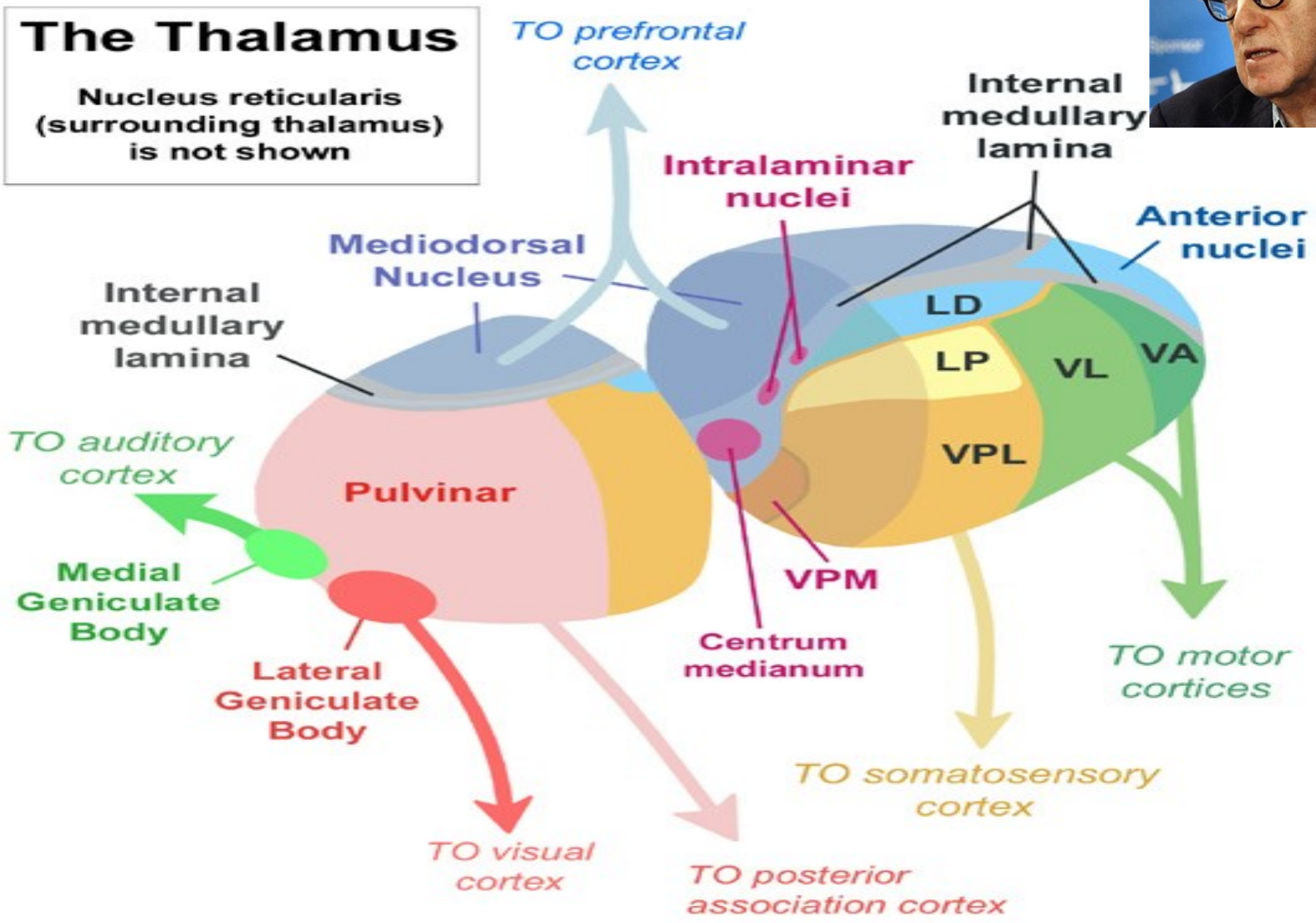
The peripheral nervous system (PNS) consists of all of the neural elements outside of the CNS (brain and spinal cord) and provides the connections between the CNS and all other body organ systems. The PNS consists of somatic and autonomic components. The somatic component innervates skeletal muscle and skin and is shown here (see Figure 2.15 for the autonomic nervous system). The somatic component of the peripheral nerves contains both motor and sensory axons. Cell bodies of the motor neurons are found in the anterior horn gray matter, whereas the cell bodies of sensory neurons are located in the dorsal root ganglia.


Message received in the thalamus and cerebral cortex
Descending pathway
Tissue -damageing stimulus activates nociceptors
Message carried to spinal cord
From brain
To brain
Skin
Nociceptors
Dorsal horn
Muscle

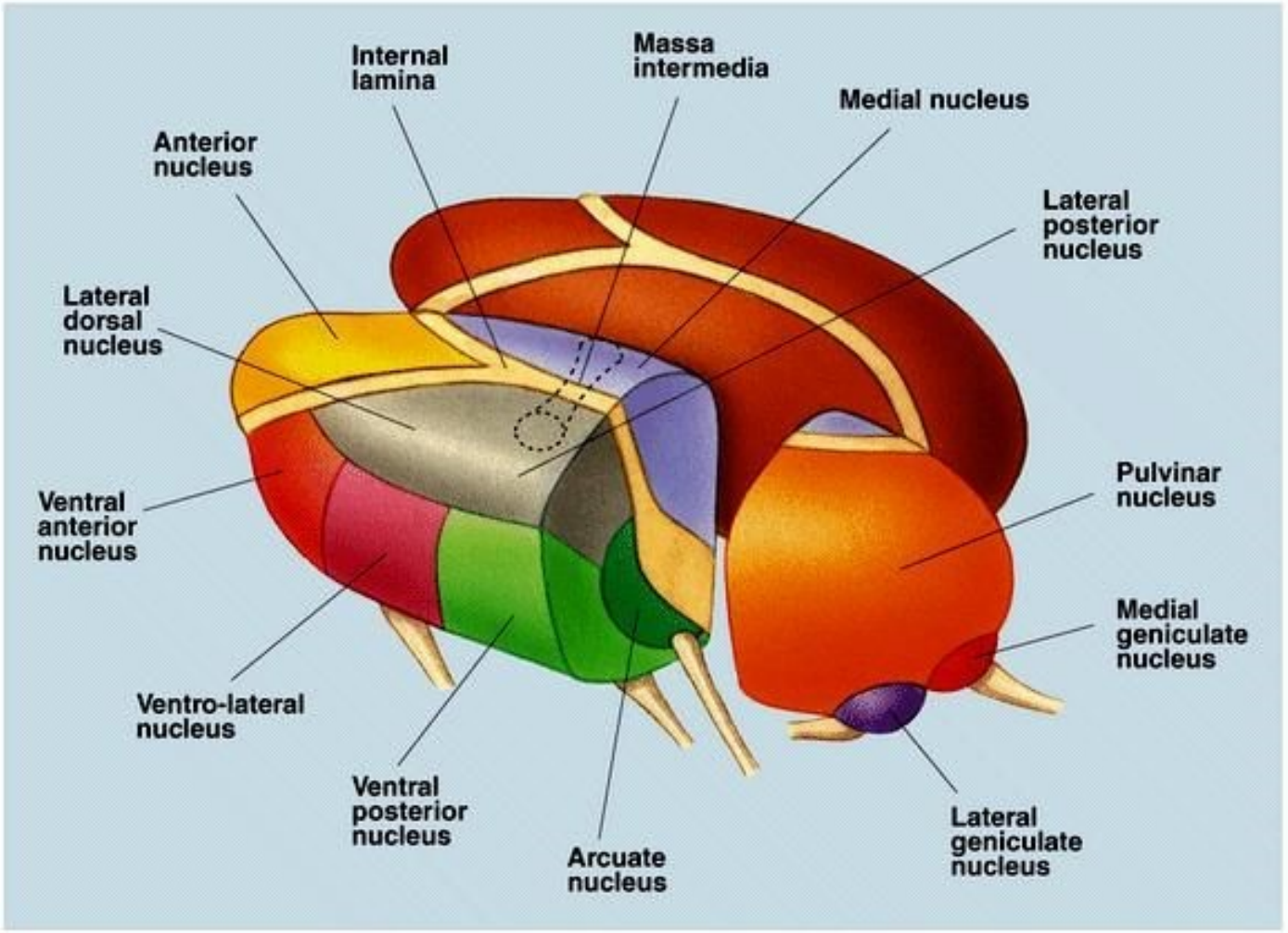
Posterior column-medial lemniscus pathway



LA CABINA DI REGIA DEL SISTEMA SENSORIALE



▶ Nuclei of the Thalamus



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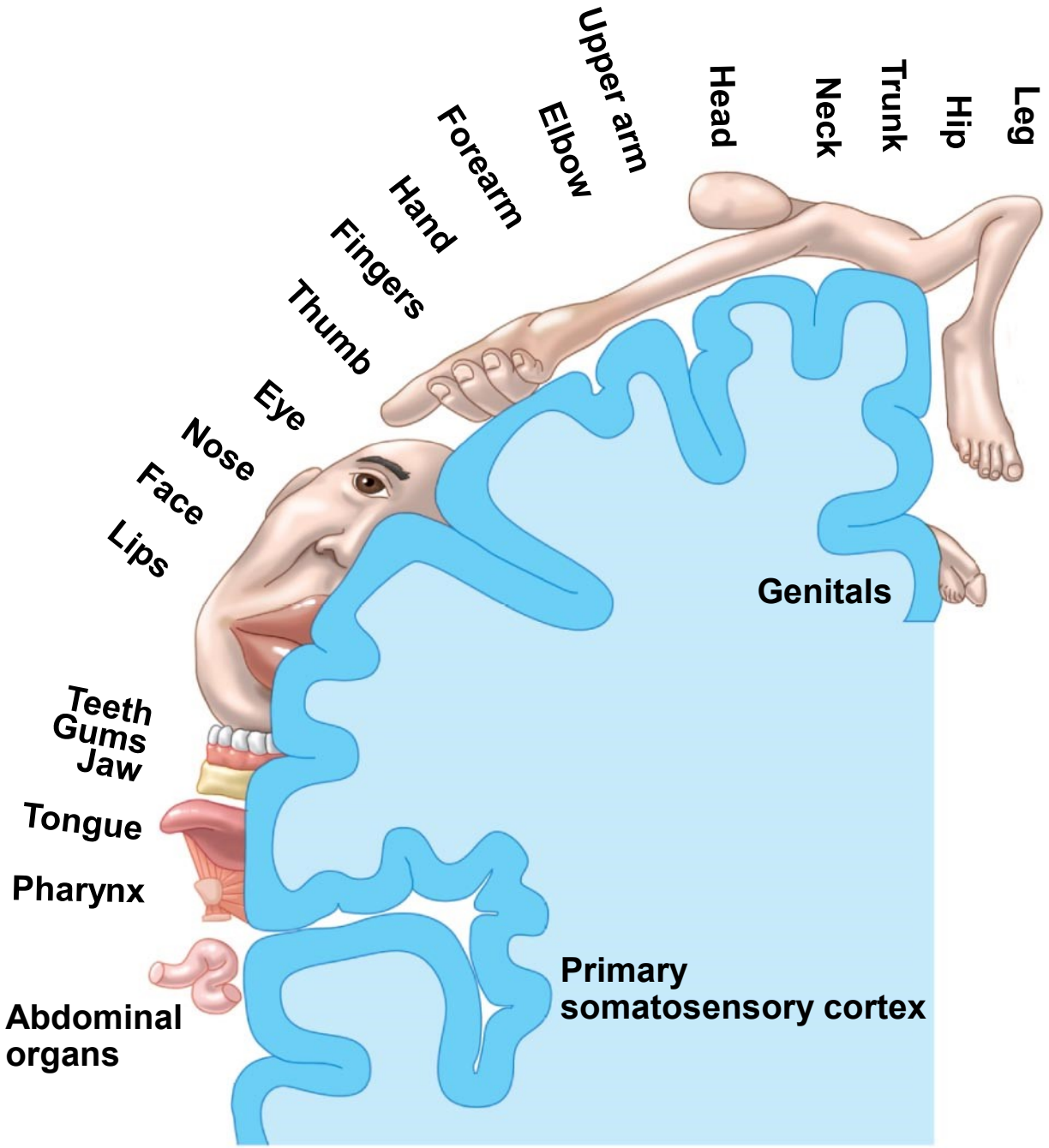
ORGANIZZAZIONE SOMATO–TOPICA DEL SISTEMA NERVOSO CENTRALE

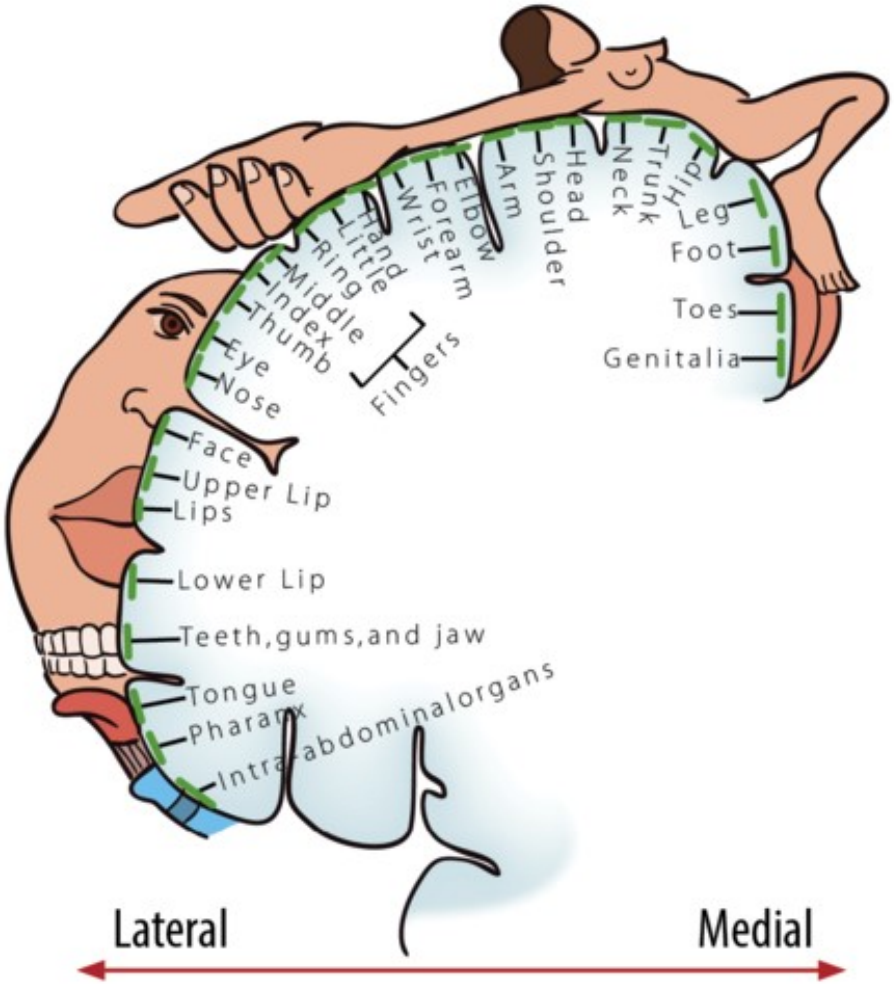
la somatotopia e' la rappresentazione delle diverse parti del corpo nelle varie strutture del Sistema Nervoso Centrale.

Essa e' fortemente presente nella corteccia cerebrale, e per ogni area specifica della corteccia assume caratteristiche distintive: per es. esiste somatotopia nella corteccia postcentrale (sensitiva) e precentrale (motoria), nel senso che nelle due aree un determinato gruppo di neuroni risponde a stimoli provenienti da una certa parte del corpo o invia segnali motori a quella stessa parte. Alcuni rappresentano le dita della mano, altri il braccio, il tronco, le gambe e cosi' via, in modo che ogni parte del corpo viene rappresentata centralmente in modo definito e topografico.

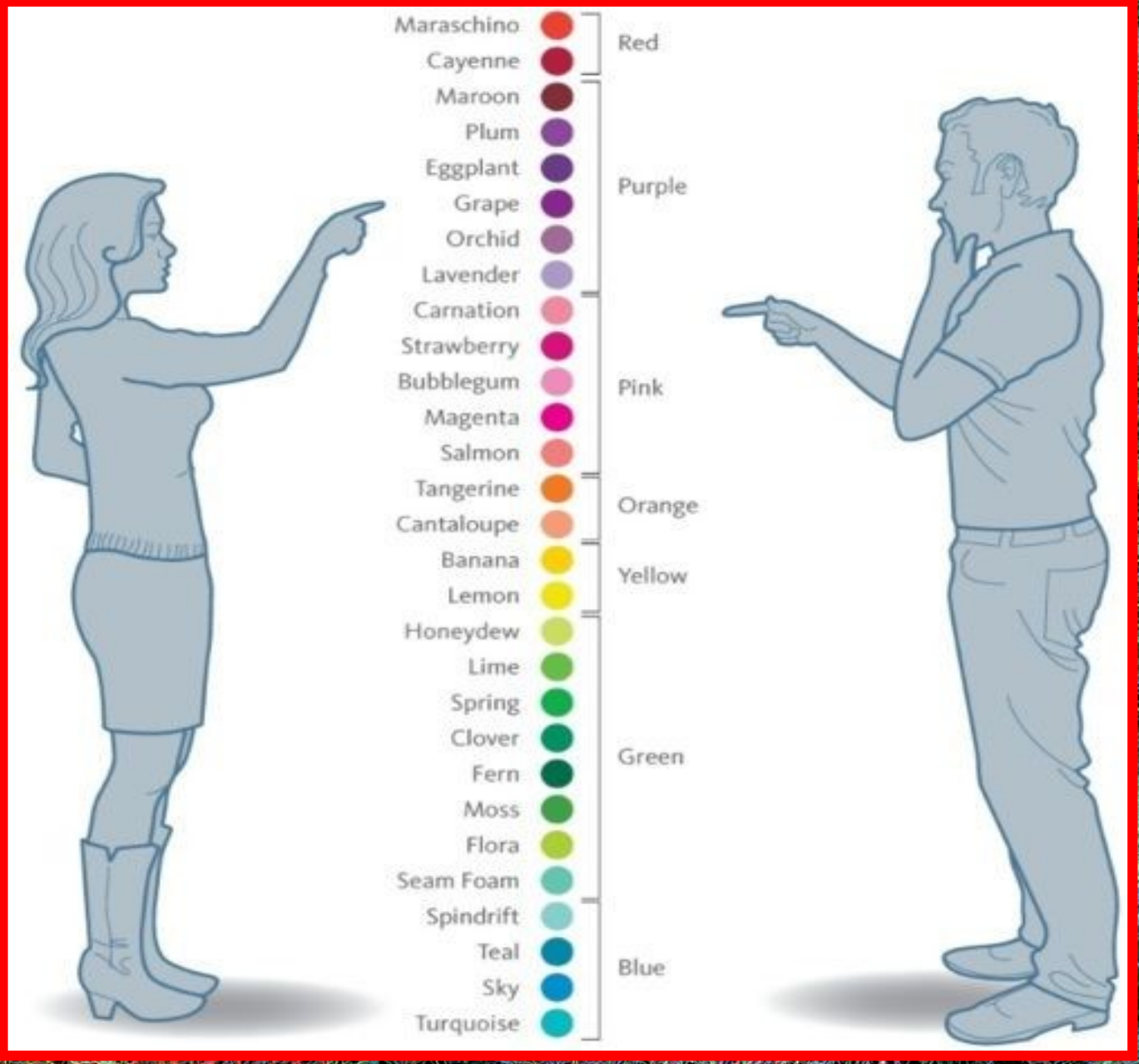
Fig. 49-16b



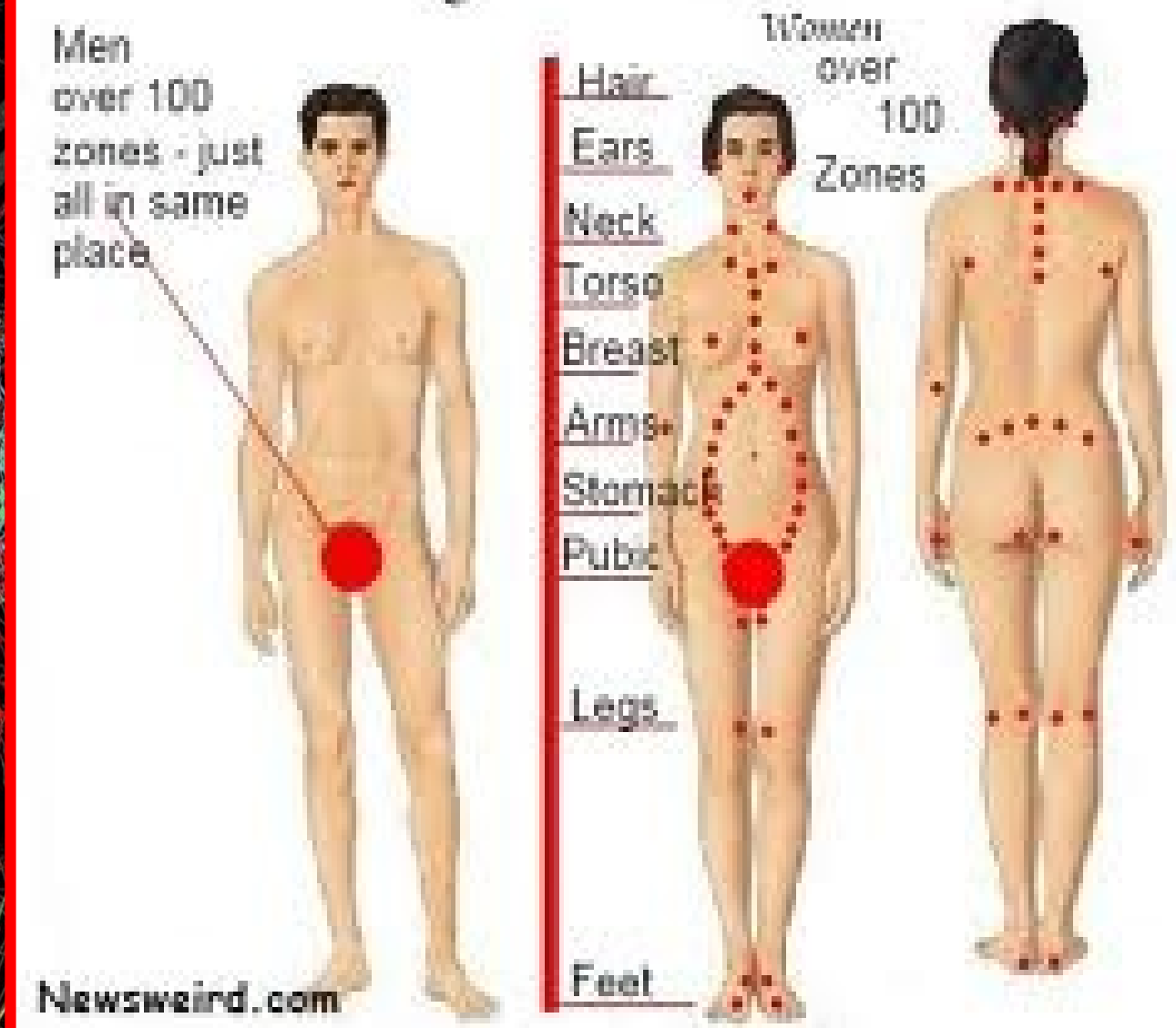
Homunculus

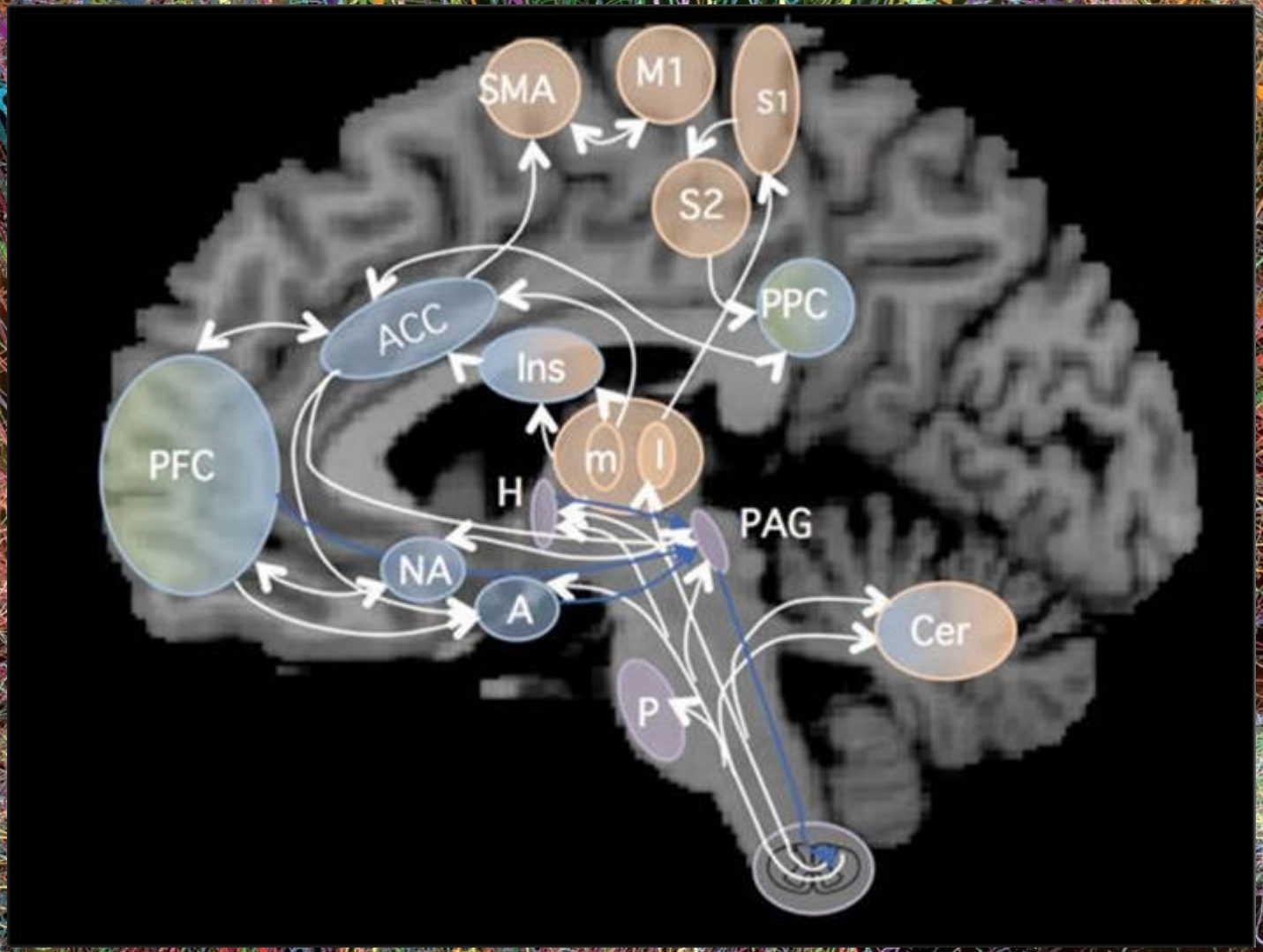


Somatosensory Map

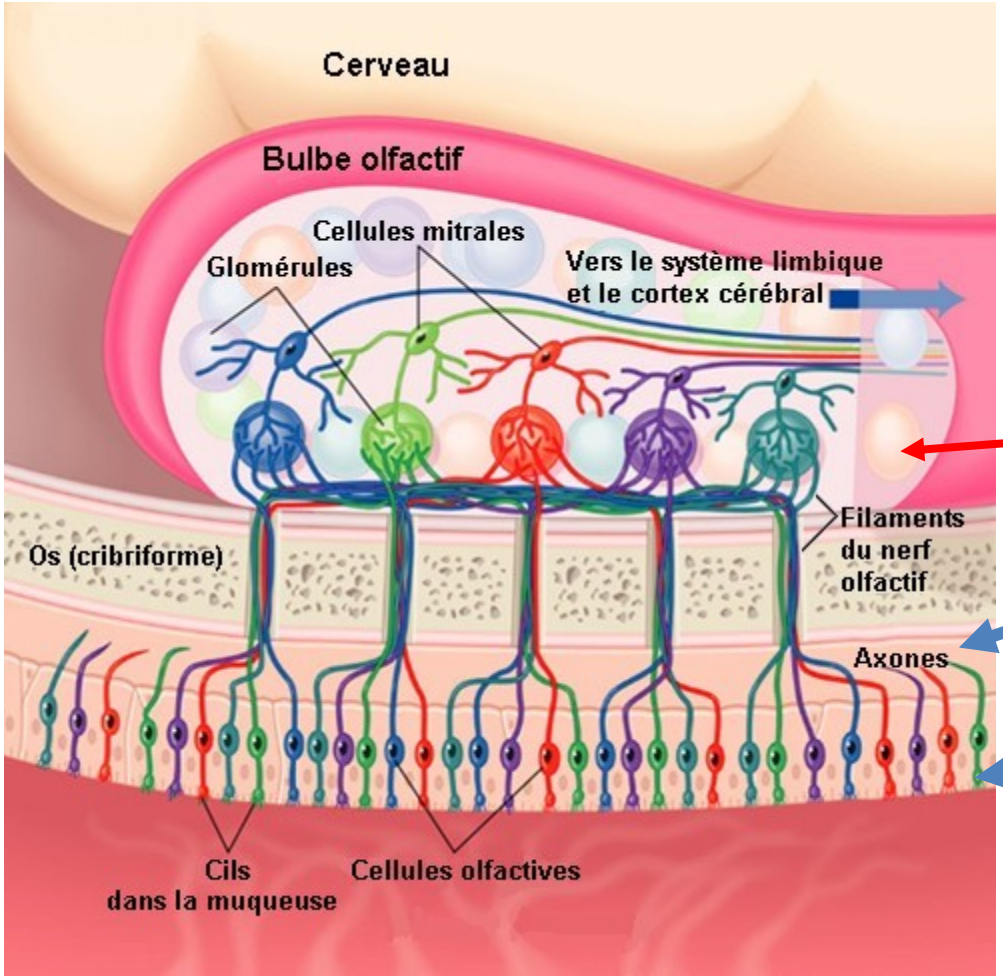


Erogenous Zones





Olfaction Update



- **Aromas processed by the limbic system first!**

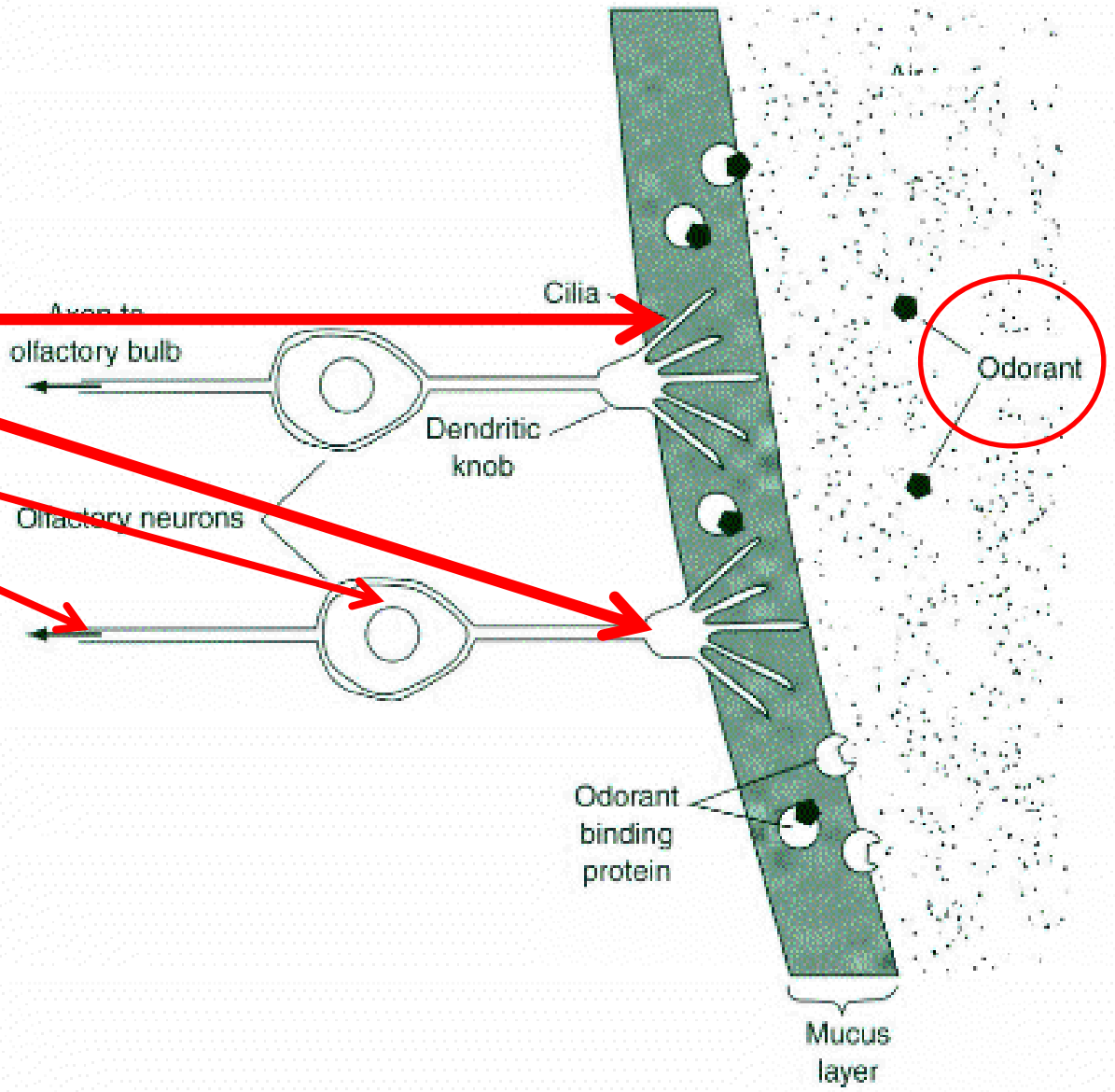
10,000 Total Glomeruli

400 Receptor Types

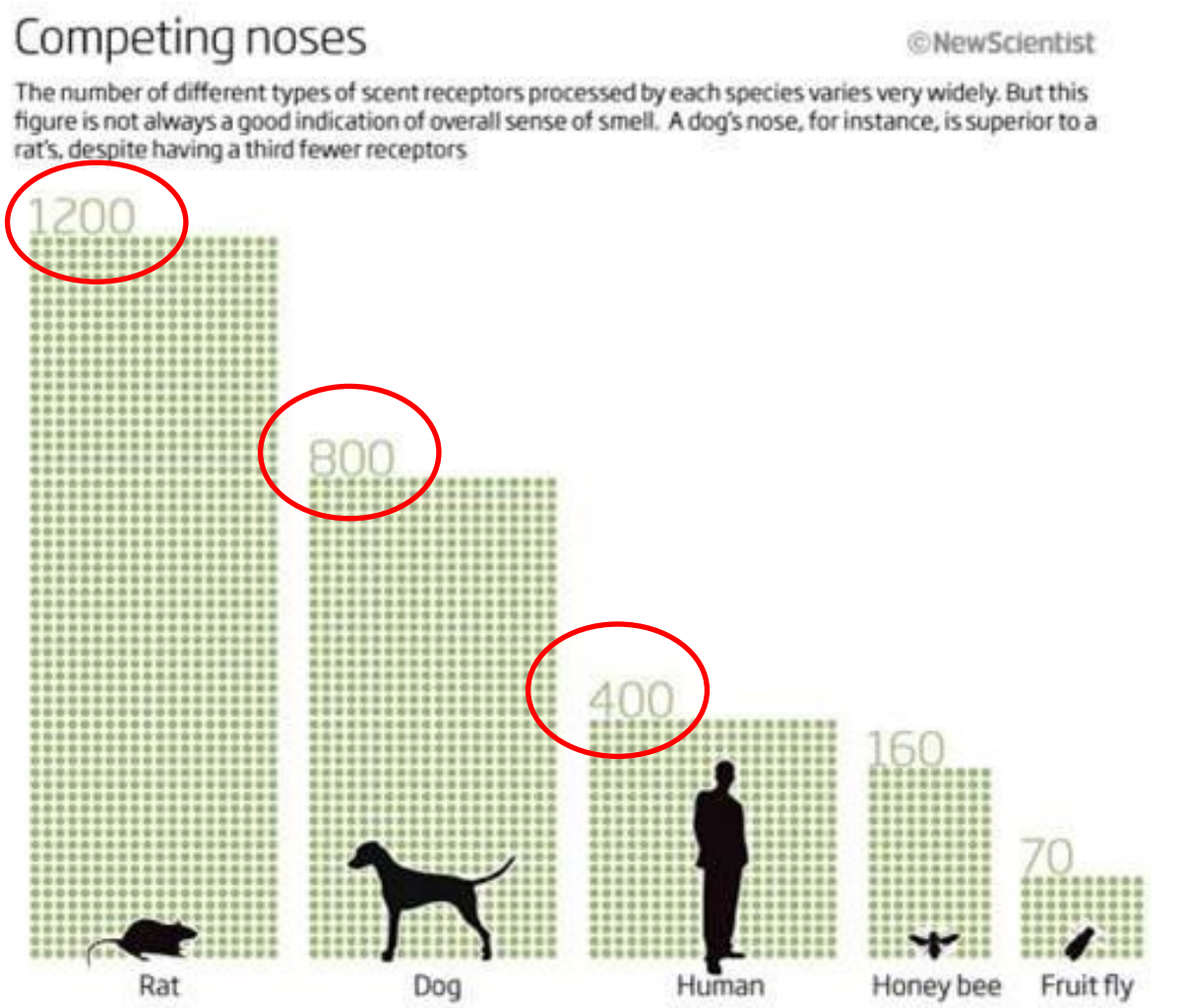
40 million receptors

Olfactory Epithelium

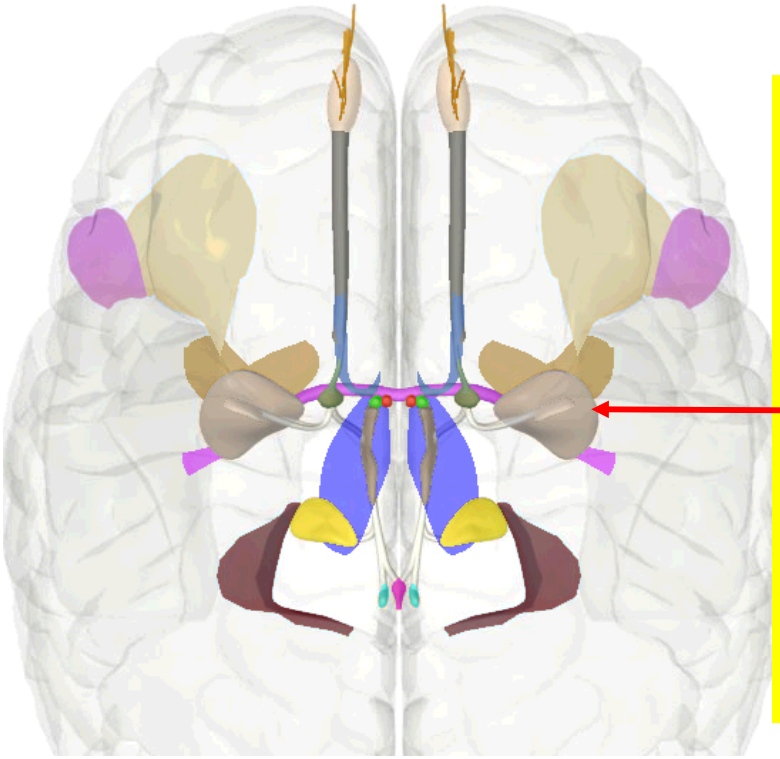
- Receptors have four parts ***cilia, olfactory knob, olfactory rod*** and the axon
- Olfactory nerve - the axons of the olfactory receptors form bands which travel to the olfactory bulb

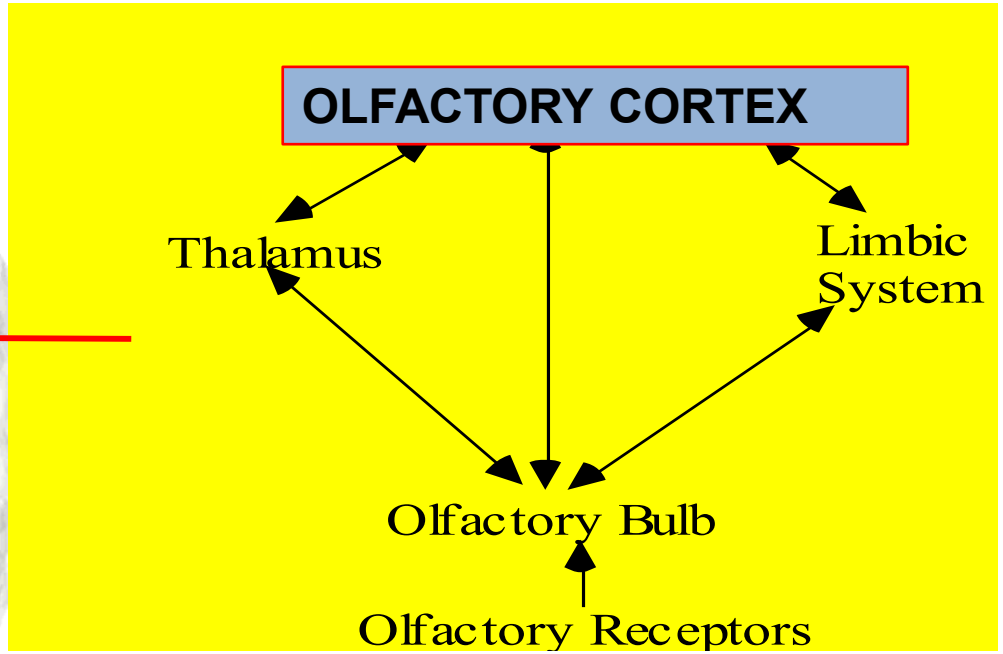


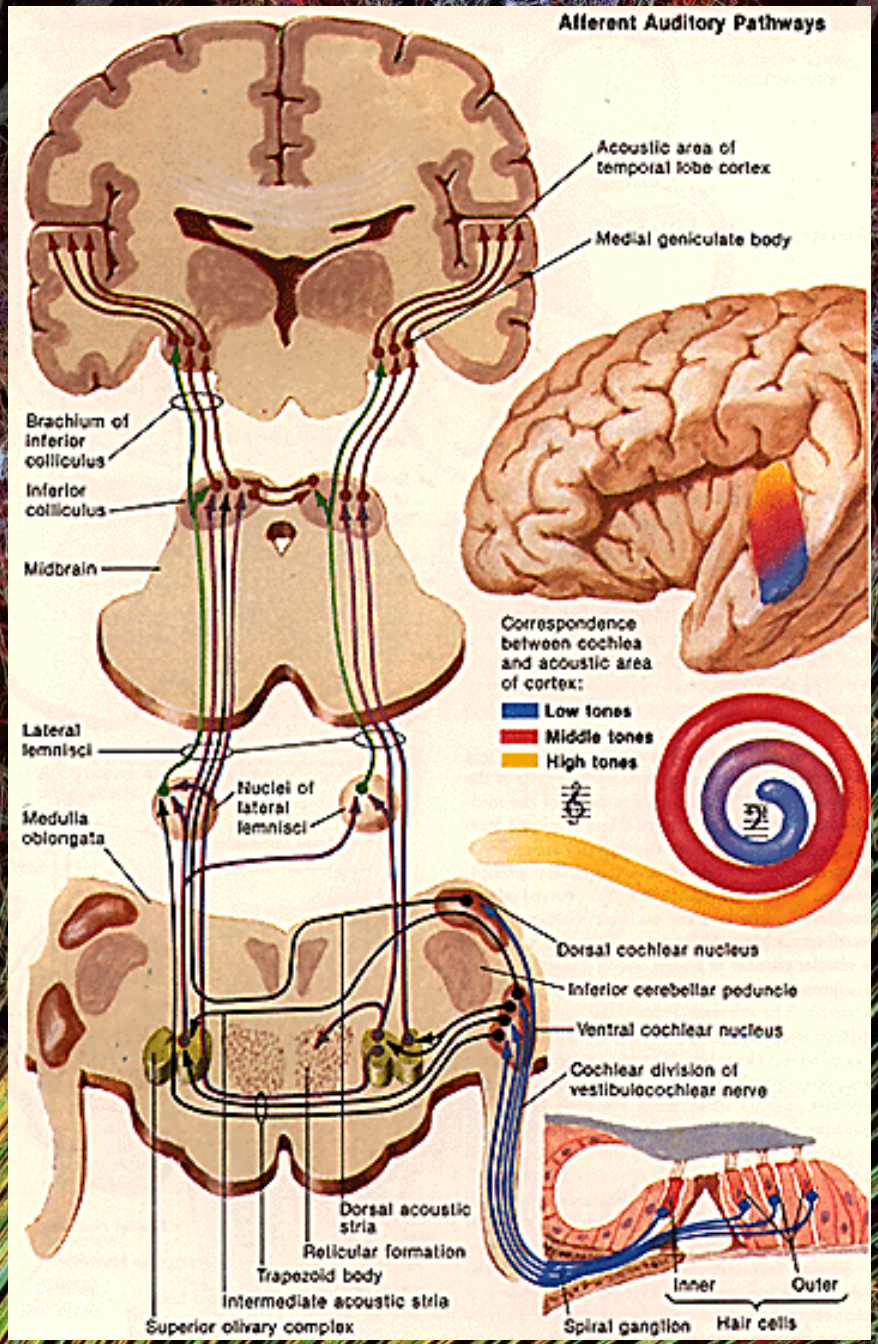
Differenti tipi e densità dei Recettori per gli stimoli olfattivi

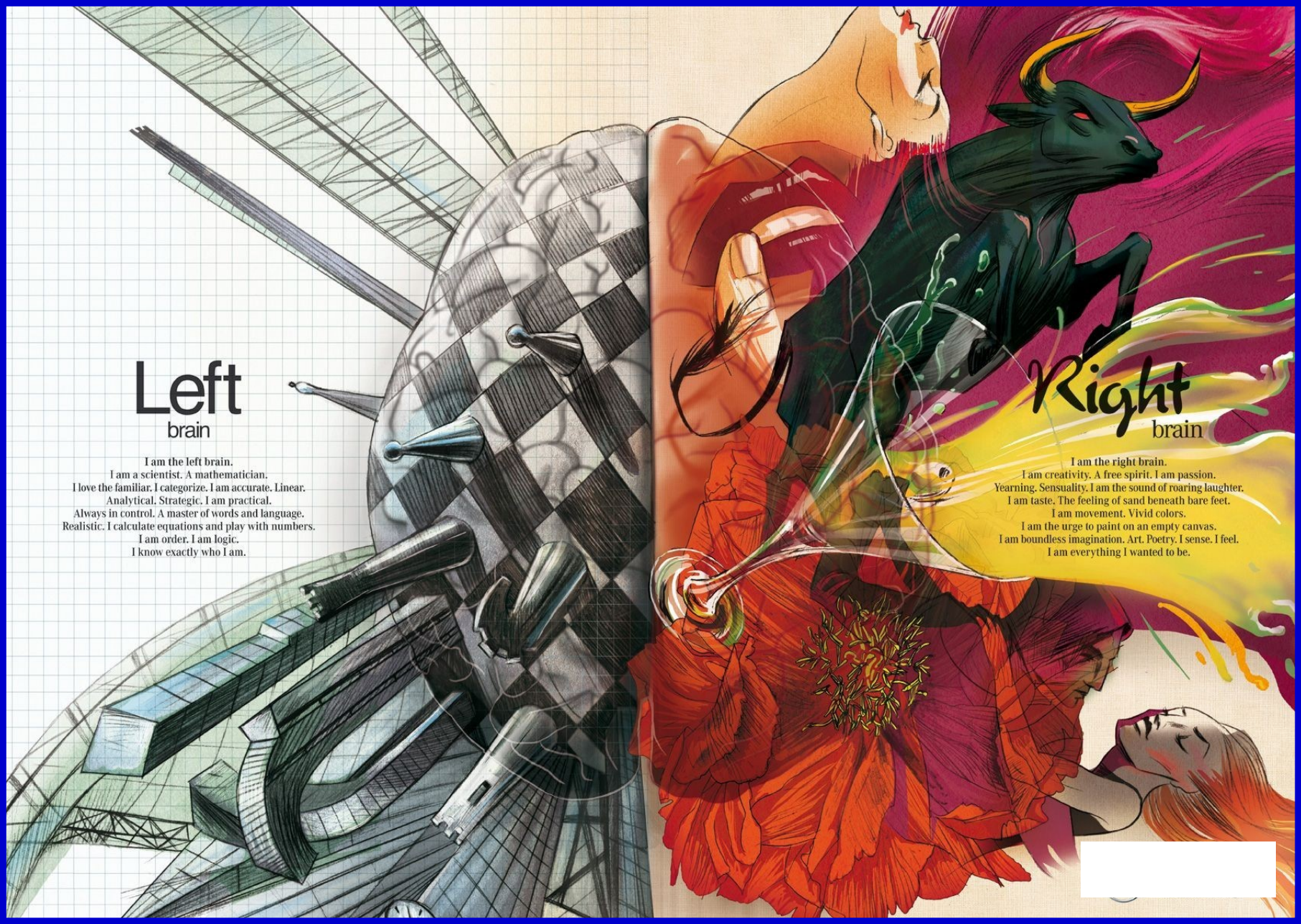


VIE dell'OLFATTO nel Sistema Nervoso Centrale






Afferent Auditory Pathways
Acoustic area of temporal lobe cortex
Medial geniculate body
Brachium of inferior colliculus
Inferior colliculus
Midbrain
Correspondence between cochlea and acoustic area of cortex:
Low tones
Middle tones
High tones
Lateral lemnisci
Nuclei of lateral lemnisci
Medulla oblongata
Dorsal cochlear nucleus
Inferior cerebellar peduncle
Ventral cochlear nucleus
Cochlear division of vestibulocochlear nerve
Dorsal acoustic stria
Reticular formation
Trapezoid body
Intermediate acoustic stria
Superior olivary complex
Inner
Outer
Spiral ganglion
Hair cells


Left
brain
I am the left brain.
I am a scientist. A mathematician.
I love the familiar. I categorize. I am accurate. Linear.
Analytical. Strategic. I am practical.
Always in control. A master of words and language.
Realistic. I calculate equations and play with numbers.
I am order. I am logic.
I know exactly who I am.
Right
brain
I am the right brain.
I am creativity. A free spirit. I am passion.
Yearning. Sensuality. I am the sound of roaring laughter.
I am taste. The feeling of sand beneath bare feet.
I am movement. Vivid colors.
I am the urge to paint on an empty canvas.
I am boundless imagination. Art. Poetry. I sense. I feel.
I am everything I wanted to be.

VISIONE O L I S T I C A
del FUNZIONAMENTO del CERVELLO

INTERCONNESSIONE COSTANTE TRA I DIVERSI SISTEMI

DATA-STORING E DATA-RETRIEVAL CONTINUI ED INCESSANTI

APPRENDIMENTO – MEMORIZZAZIONE – RICONOSCIMENTO

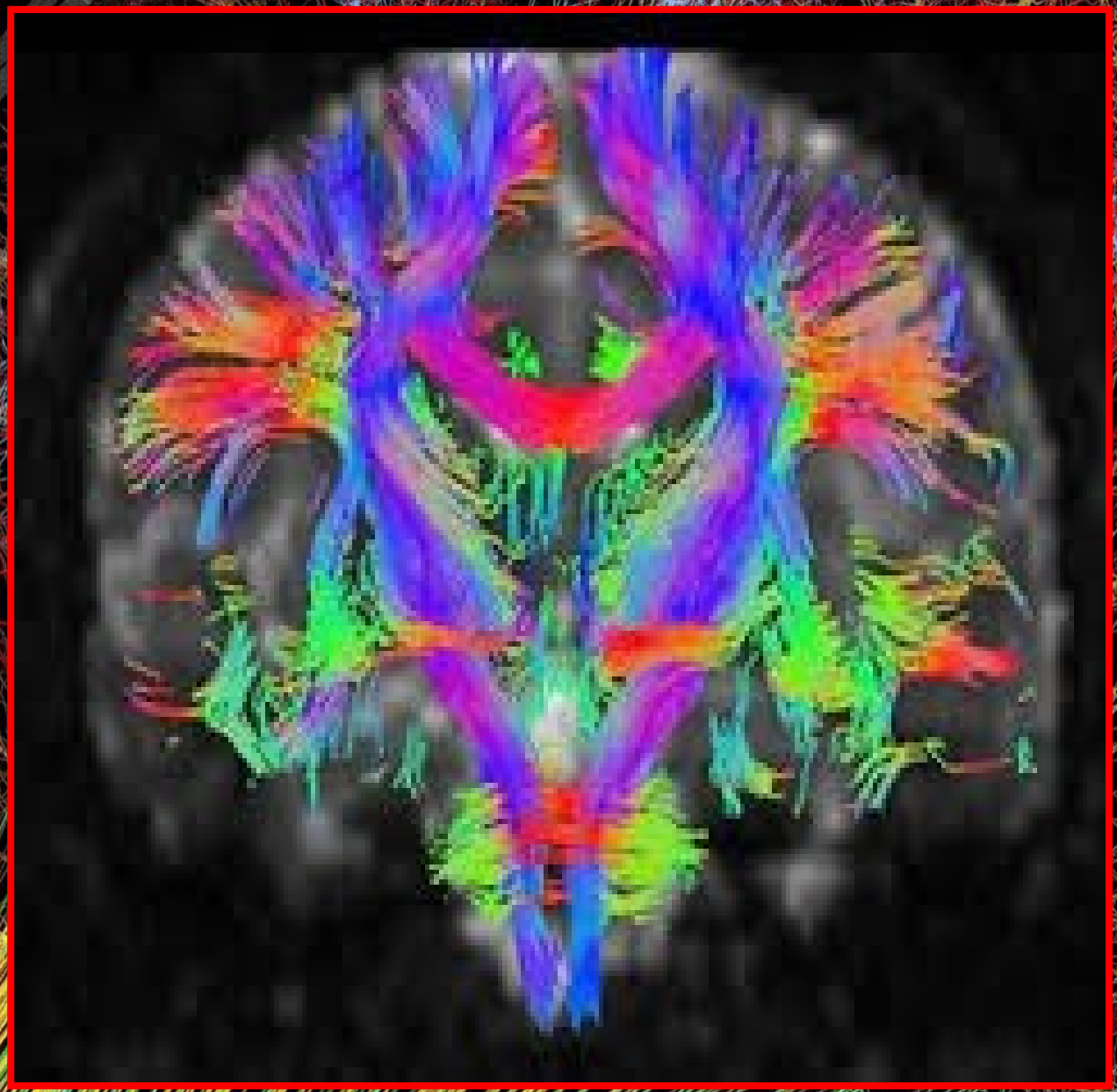
ATTIVITA' STRETTAMENTE CORRELATE ED INTERCONNESSE

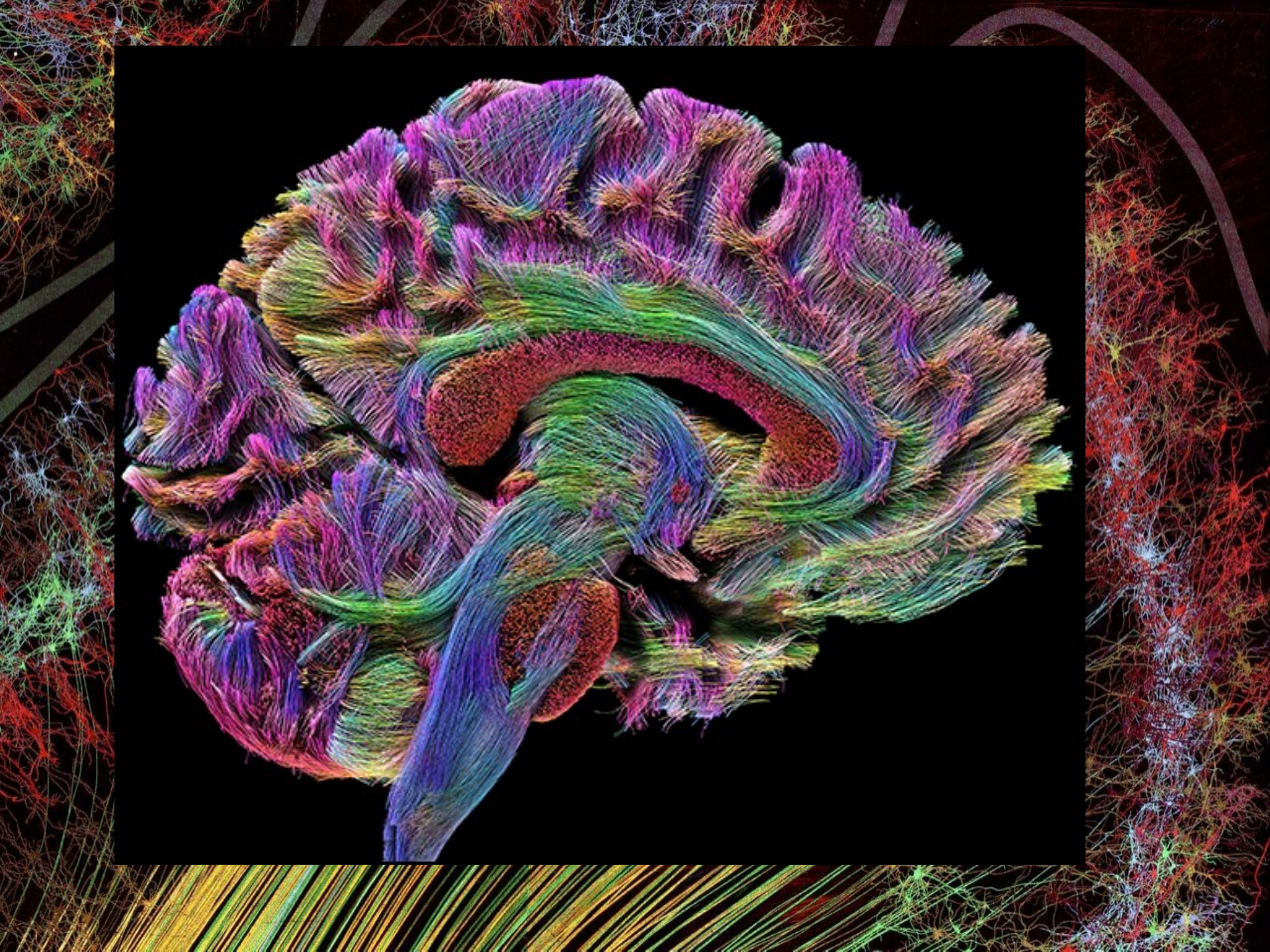
IMPORTANZA DELLA " COLORITURA " EMOTIVO-AFFETTIVA
DELLE TRACCE MNESICHE :
I COLORI ED I PROFUMI DELLA MEMORIA

MEMORIE CONTINUAMENTE " SOVRASCRITTE "

IL PUNTO DI OSSERVAZIONE versus OGGETTO DELLA OSSERVAZIONE

RM Encefalo con Studio Trattografico mediante Tensori di Diffusione .
Connessioni intra ed interemisferiche e vie cortico-spinali.





July 2014 | Volume 9 | Issue 7 | e103038

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PLOS | ONE

Autism and Sensory Processing Disorders: Shared White Matter Disruption in Sensory Pathways but Divergent Connectivity in Social-Emotional Pathways

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Abstract

Over 90% of children with Autism Spectrum Disorders (ASD) demonstrate atypical sensory behaviors. In fact, hyper- or hyporeactivity to sensory input or unusual interest in sensory aspects of the environment is now included in the DSM-5 diagnostic criteria. However, there are children with sensory processing differences who do not meet an ASD diagnosis but do show atypical sensory behaviors to the same or greater degree as ASD children. We previously demonstrated that children with Sensory Processing Disorders (SPD) have impaired white matter microstructure, and that this white matter microstructural pathology correlates with atypical sensory behavior. In this study, we use diffusion tensor imaging (DTI) fiber tractography to evaluate the structural connectivity of specific white matter tracts in boys with ASD (n = 15) and boys with SPD (n = 16), relative to typically developing children (n = 23). We define white matter tracts using probabilistic streamline tractography and assess the strength of tract connectivity using mean fractional anisotropy. Both the SPD and ASD cohorts demonstrate decreased connectivity relative to controls in parieto-occipital tracts involved in sensory perception and multisensory integration. However, the ASD group alone shows impaired connectivity, relative to controls, in temporal tracts thought to subserve social-emotional processing. In addition to these group difference analyses, we take a dimensional approach to assessing the relationship between white matter connectivity and participant function. These correlational analyses reveal significant associations of white matter connectivity with auditory processing, working

doi:10.1093/brain/awy191 BRAIN 2018: 141; 2795–2805 | 2795

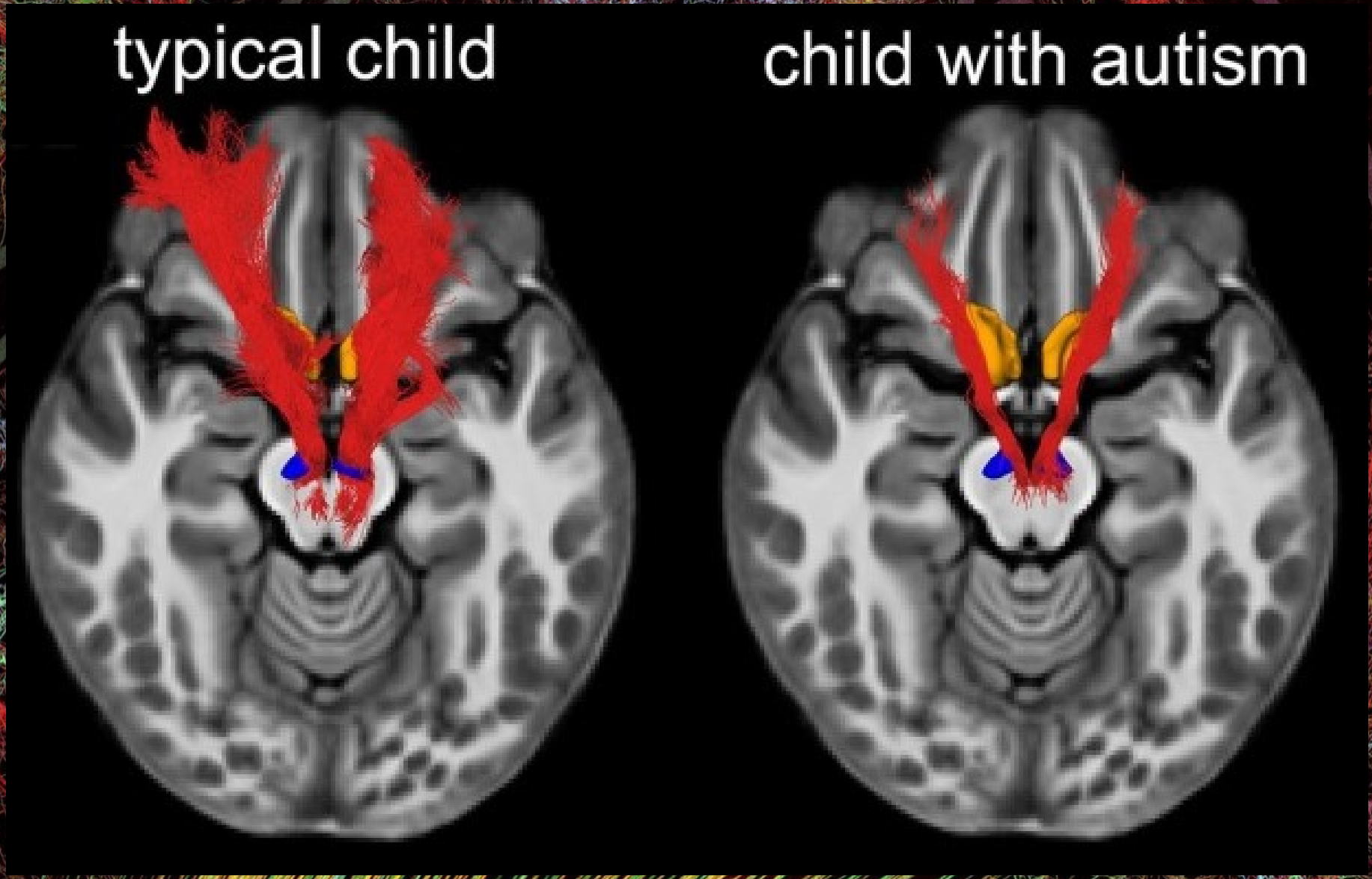
BRAIN
A JOURNAL OF NEUROLOGY

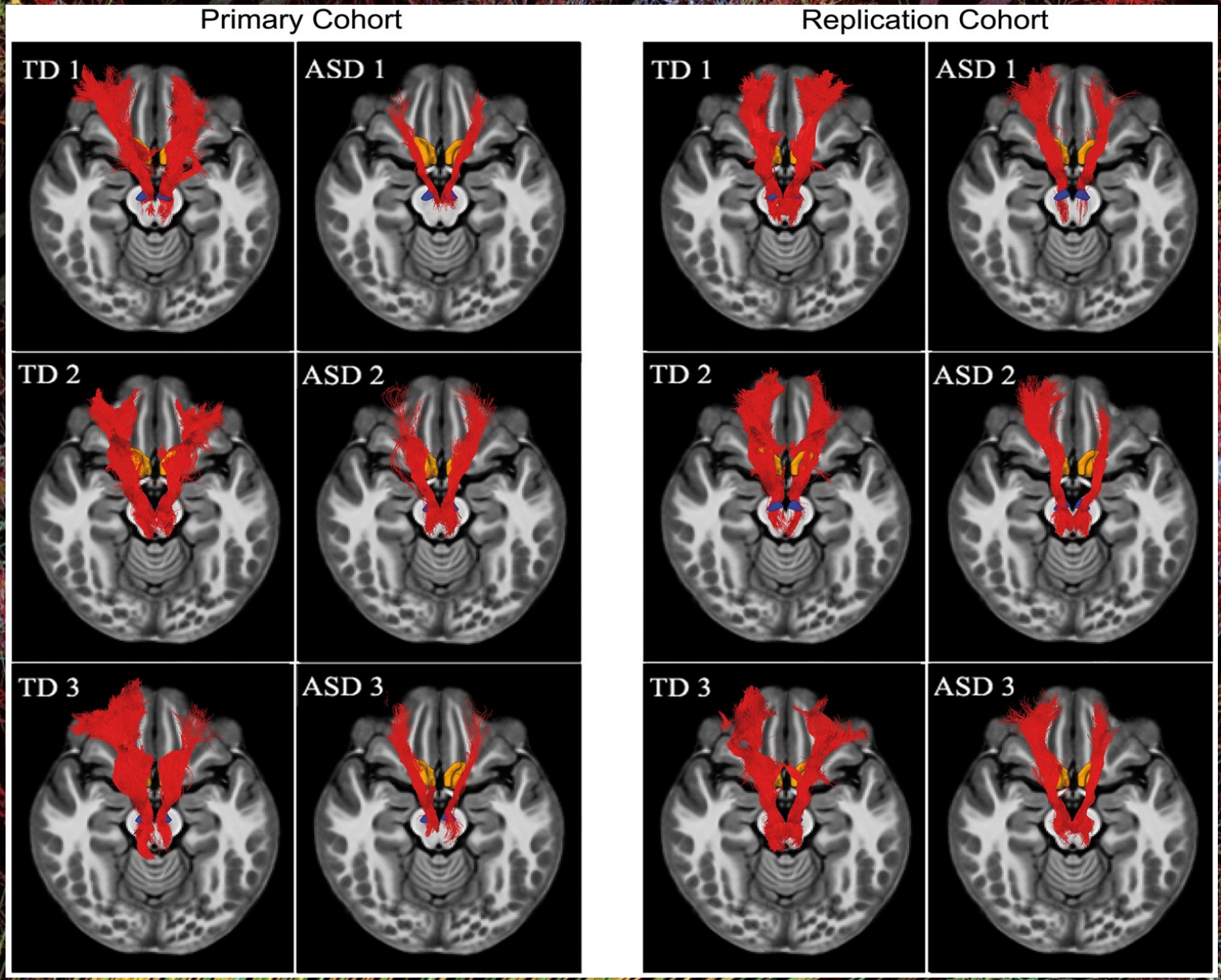
Deficits in mesolimbic reward pathway underlie social interaction impairments in children with autism

Kaustubh Supekar,[1]* John Kochalka,[1]* Marie Schaer,[1,2] Holly Wakeman,[1] Shaozheng Qin,[1,3] Aarthi Padmanabhan[1] and Vinod Menon[1,4,5]

*These authors contributed equally to this work.

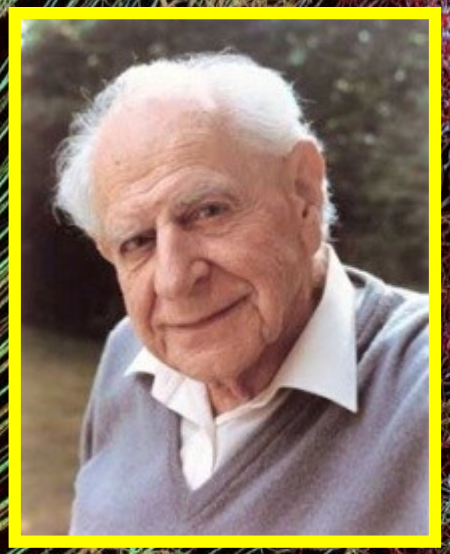
Lack of interest in social interaction is a hallmark of autism spectrum disorder. Animal studies have implicated the mesolimbic reward pathway in driving and reinforcing social behaviour, but little is known about the integrity of this pathway and its behavioural consequences in children with autism spectrum disorder. Here we test the hypothesis that the structural and functional integrity of the mesolimbic reward pathway is aberrant in children with autism spectrum disorder, and these aberrancies contribute to the social interaction impairments. We examine structural and functional connectivity of the mesolimbic reward pathway in two independent cohorts totalling 82 children aged 7–13 years with autism spectrum disorder and age-, gender-, and intelligence quotient-matched typically developing children (primary cohort: children with autism spectrum disorder $n = 24$, typically developing children $n = 24$; replication cohort: children with autism spectrum disorder $n = 17$, typically developing children $n = 17$), using high angular resolution diffusion-weighted imaging and functional MRI data. We reliably identify white matter tracts linking—the nucleus accumbens and the ventral tegmental area—key subcortical nodes of the mesolimbic reward pathway, and provide reproducible evidence for structural aberrations in these tracts in children with autism spectrum disorder. Further, we show that structural aberrations are accompanied by aberrant functional interactions between nucleus accumbens and ventral tegmental area in response to social stimuli. Crucially, we demonstrate that both structural and functional circuit aberrations in the mesolimbic reward pathway are related to parent-report measures of social interaction impairments in affected children. Our findings, replicated across two independent cohorts, reveal that deficits in the mesolimbic reward pathway contribute to impaired social skills in

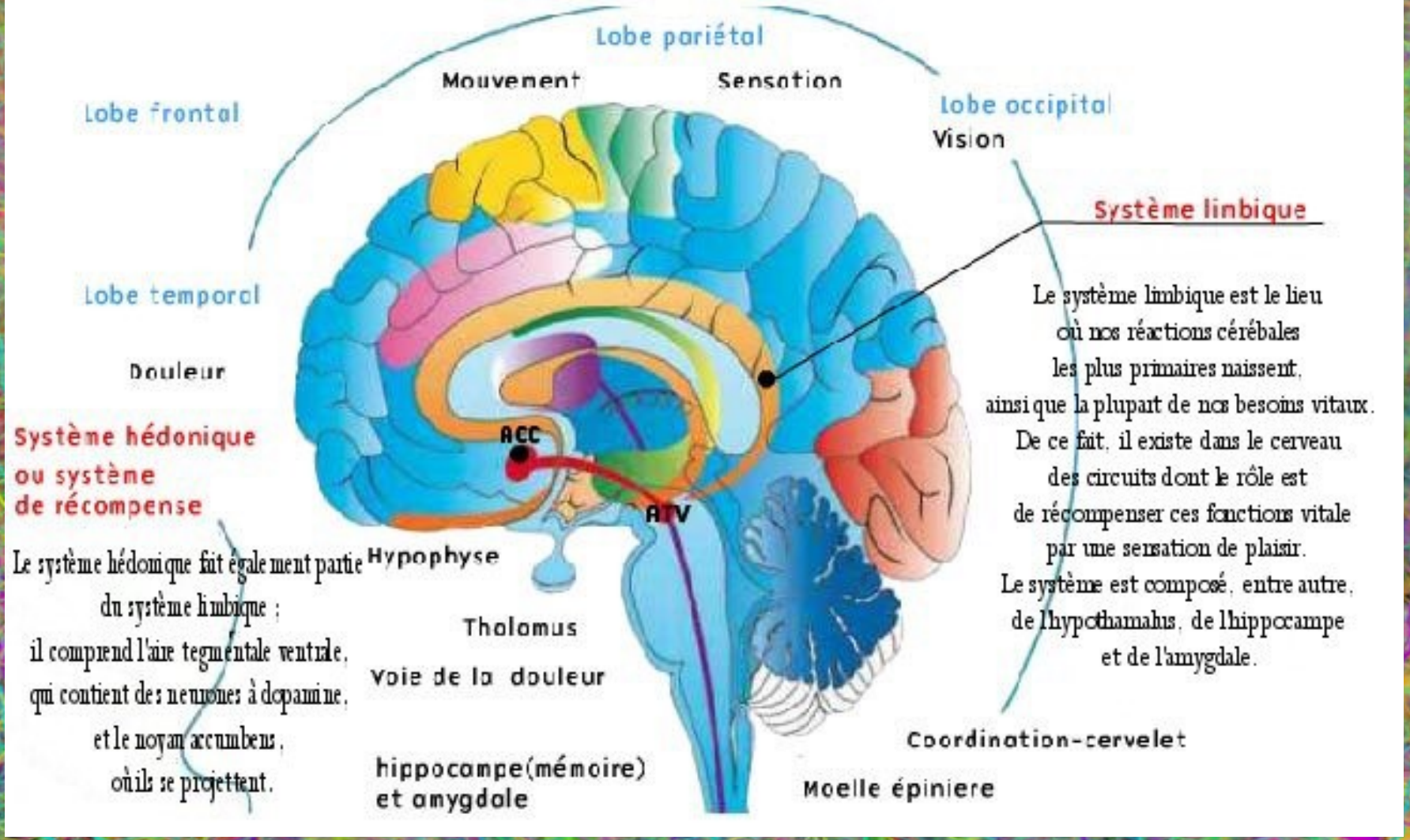

typical child
child with autism


Primary Cohort
Replication Cohort
TD 1
ASD 1
TD 2
ASD 2
TD 3
ASD 3
TD 1
ASD 1
TD 2
ASD 2
TD 3
ASD 3

Those, among us, who are unwilling to expose their ideas to the hazard of refutation do not take part in the scientific game . **Karl Popper**

The Logic of Scientific Discovery, 1959.



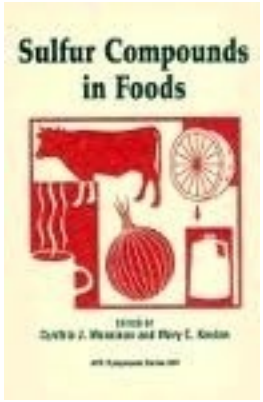


Le système limbique est le lieu
où nos réactions cérébales
les plus primaires naissent,
ainsi que la plupart de nos besoins vitaux.
De ce fait, il existe dans le cerveau
des circuits dont le rôle est
de récompenser ces fonctions vitale
par une sensation de plaisir.
Le système est composé, entre autre,
de l'hypothamalus, de l'hippocampe
et de l'amygdale.

Le système hédonique fait également partie
du système limbique ;
il comprend l'aire tegmentale ventrale,
qui contient des neurones à dopamine,
et le noyau accumbens,
où ils se projettent.

Complessita' degli Aromi

- Nel cervello umano sono presenti più connessioni sinaptiche relative all'OLFATTO che in qualsiasi altro animale
- La sensibilità per le sotanze **Solforate**
- è *Impressionante !*



Olfaction is Under-rated in Humans!

- Human: *More genes for aroma than any other organ*!
  - **40 million receptor cells**
  - **Class I, OR52D1 (Aquatic Genes, 20% genes)**
    - **Narrow Tuning, Few Pseudogenes, Important**
    - **Soluble Meats & Fatty Acids, Amino Acids, Hormones**
  - **Class II, OR1G1 (Terrestrial Gene)**
    - **Broadly tuned likes C9-10 chain length**
- **Humans are Sensitive to Cooked aromas**
  - **Equal to Dogs**

http://www.genomenewsnetwork.org/articles/02_02/scent_mice.shtml

TAARS Receptors

Trace Amine-Associated Receptors

- Pheromone **perception**
  - **Marking territories, sweat, urine**
- **Volatile Amines (biogenic amines)**
  - **Trimethylamine (decomposition)**
    - **Fish, prawn aroma**
    - **Meats, vegetables also (Soy, peanuts)**
    - **Olfactory sense for choline**
    - **Destruction: acidity (lemon juice)**
    - **Cheese, beer (fermentation)**


sandro sangiorgi
L'invenzione della gioia
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Hédoniste
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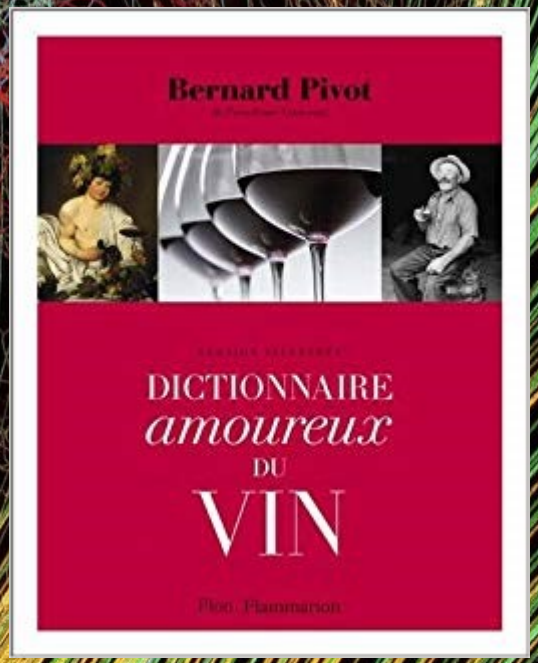
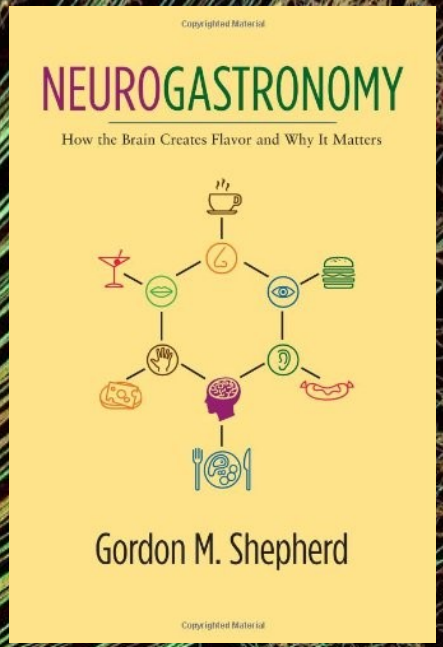
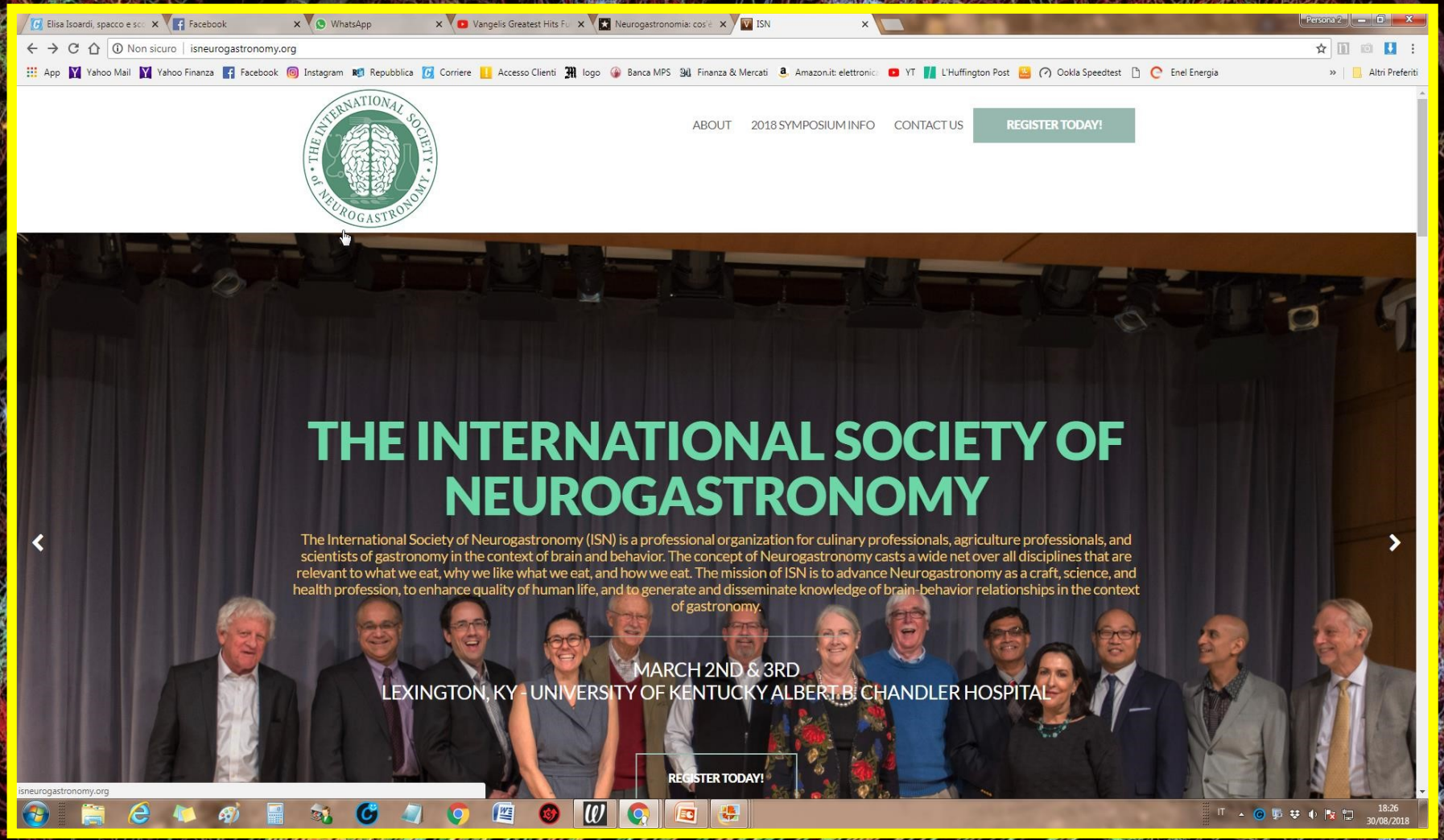

Bernard Pivot
DICTIONNAIRE
amoureux
DU
VIN
Plon Flammarion


NEUROGASTRONOMY
How the Brain Creates Flavor and Why It Matters
Gordon M. Shepherd

Enofora Callipigia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The International Society of Neurogastronomy (ISN) is a professional organization for culinary professionals, agriculture professionals, and scientists of gastronomy in the context of brain and behavior. The concept of Neurogastronomy casts a wide net over all disciplines that are relevant to what we eat, why we like what we eat, and how we eat. The mission of ISN is to advance Neurogastronomy as a craft, science, and health profession, to enhance quality of human life, and to generate and disseminate knowledge of brain-behavior relationships in the context of gastronomy.
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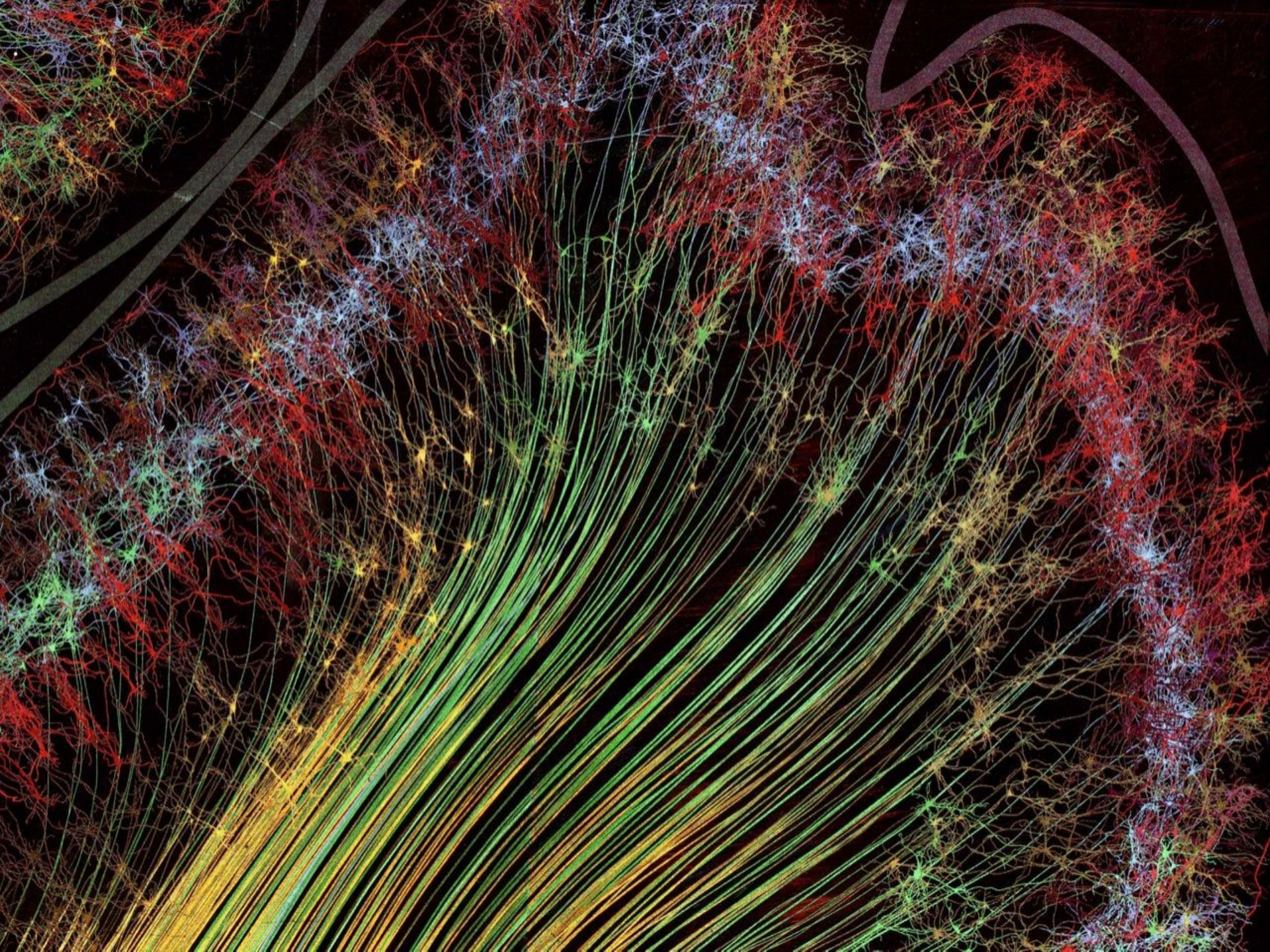
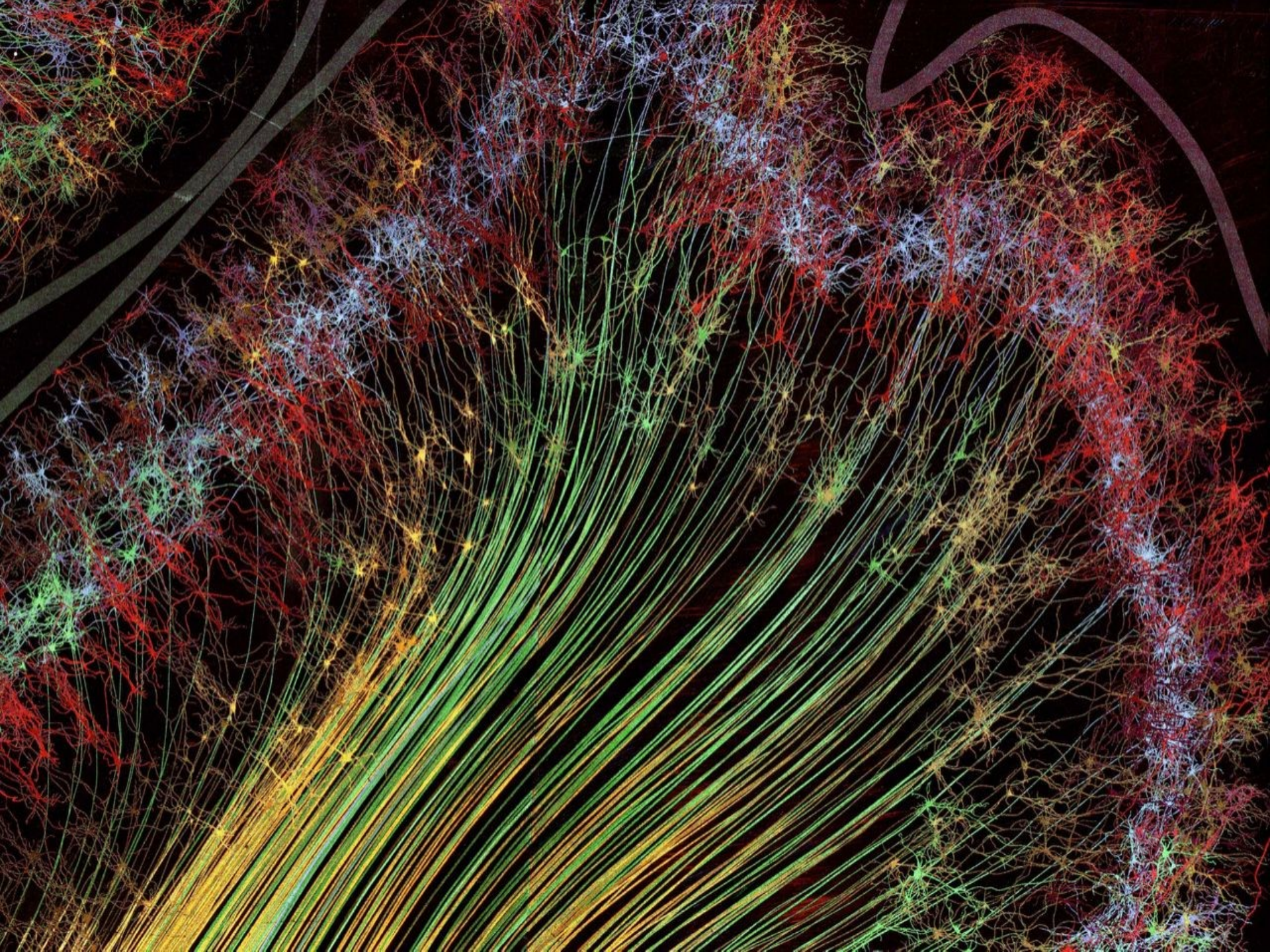
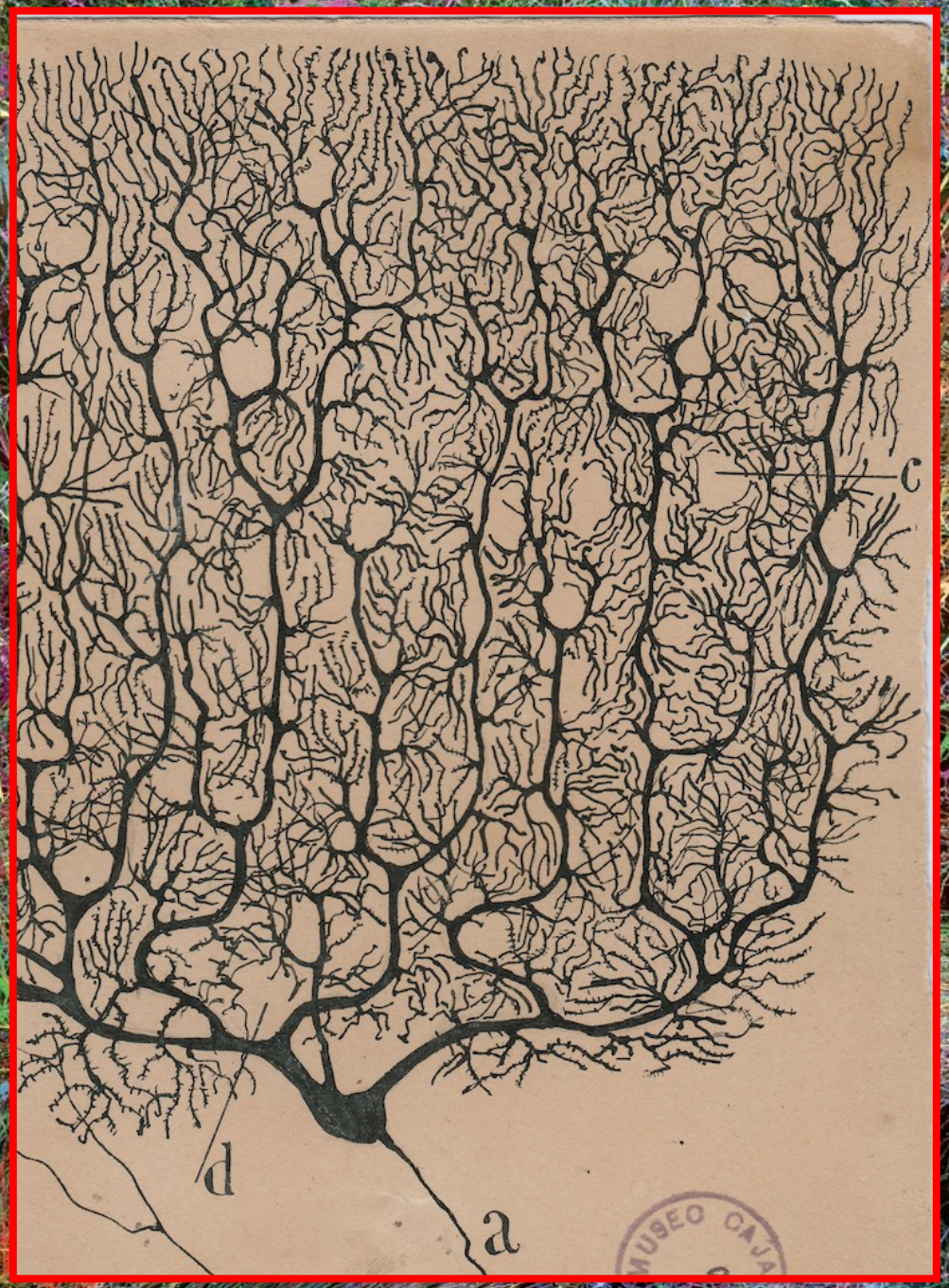
“One cannot think well,
make love well ,
or sleep well ,
if one has not dined well.”

Virginia Woolfe





Camillo GOLGI



Pregalo hecho por el Dr Cajal

SULLA FINA STRUTTURA

DEI

BULBI OLFATTORII

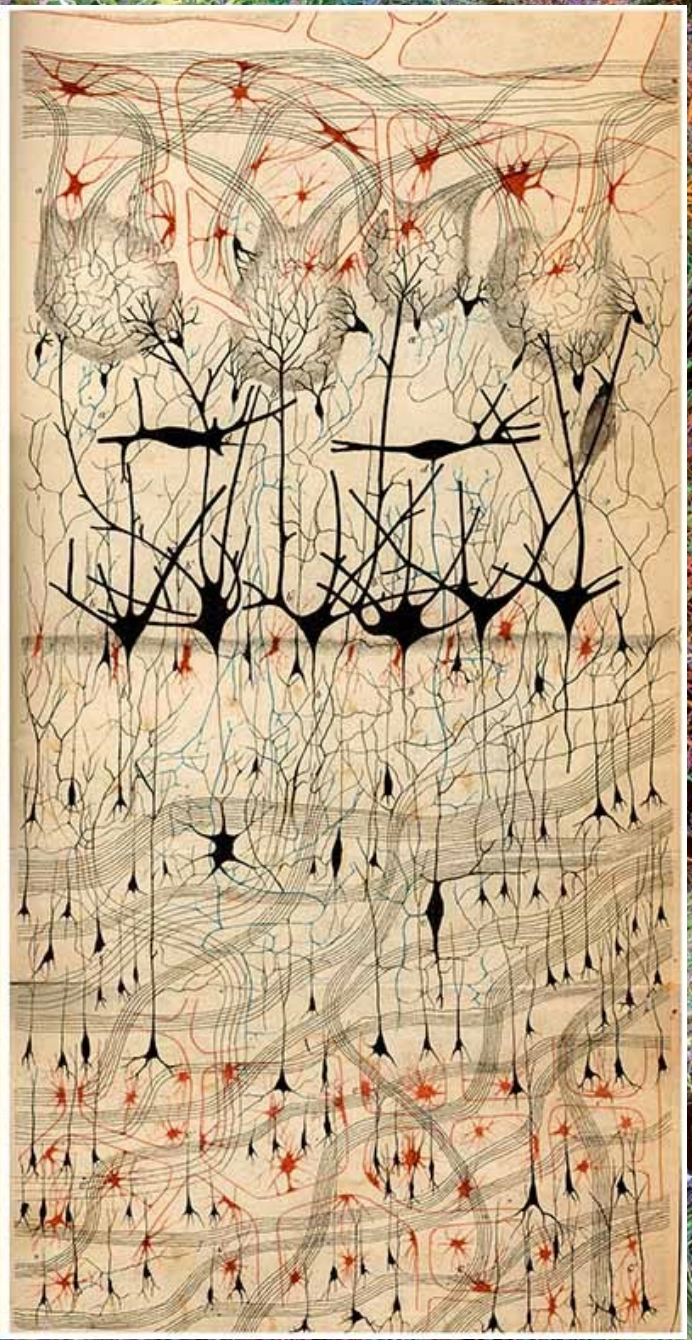
RICERCHE

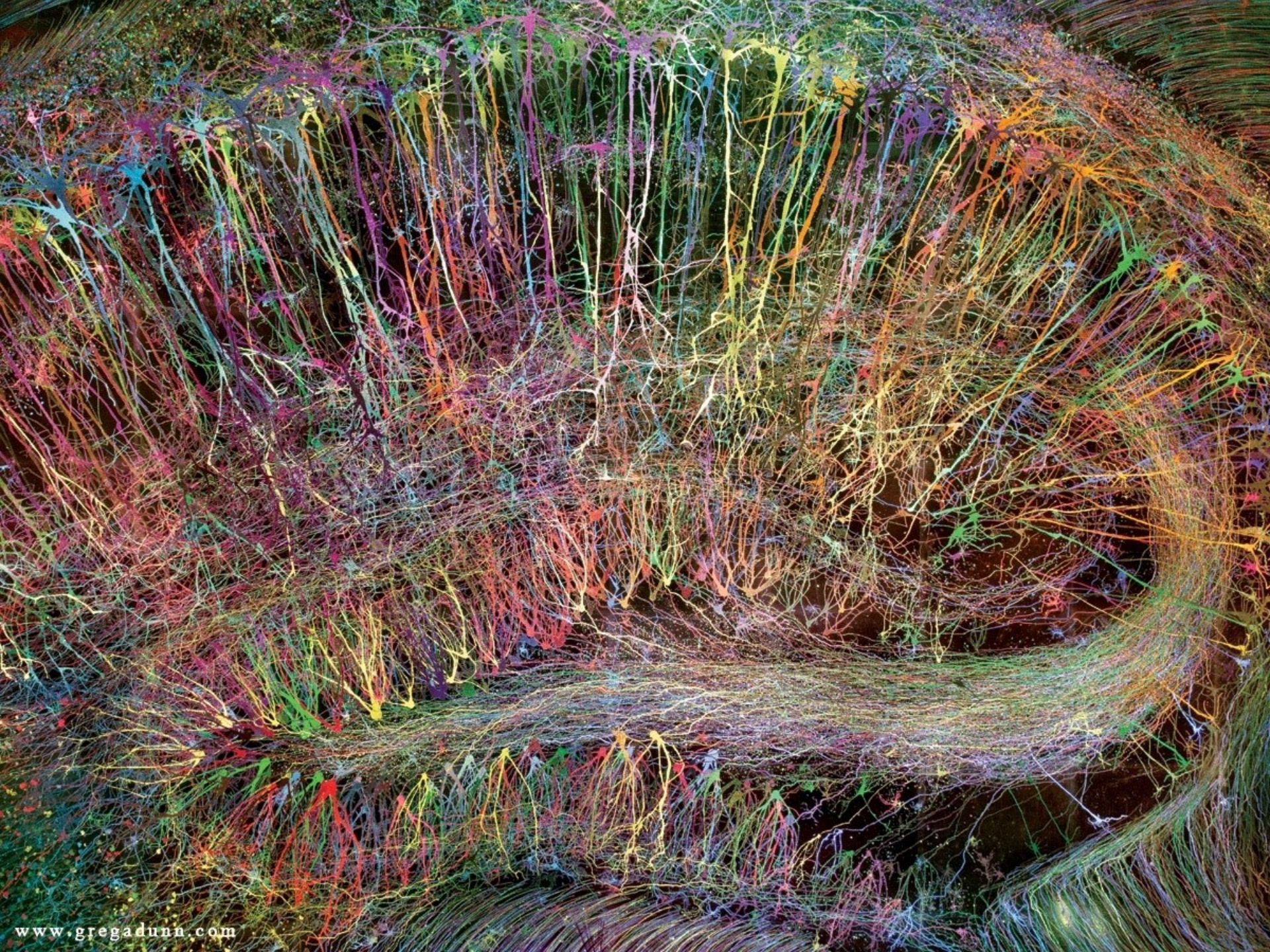
DEL

DOTT. CAMILLO GOLGI

(Con una tavola litog.)

REGGIO-EMILIA
TIPOGRAFIA DI STEFANO CALDERINI
1875.

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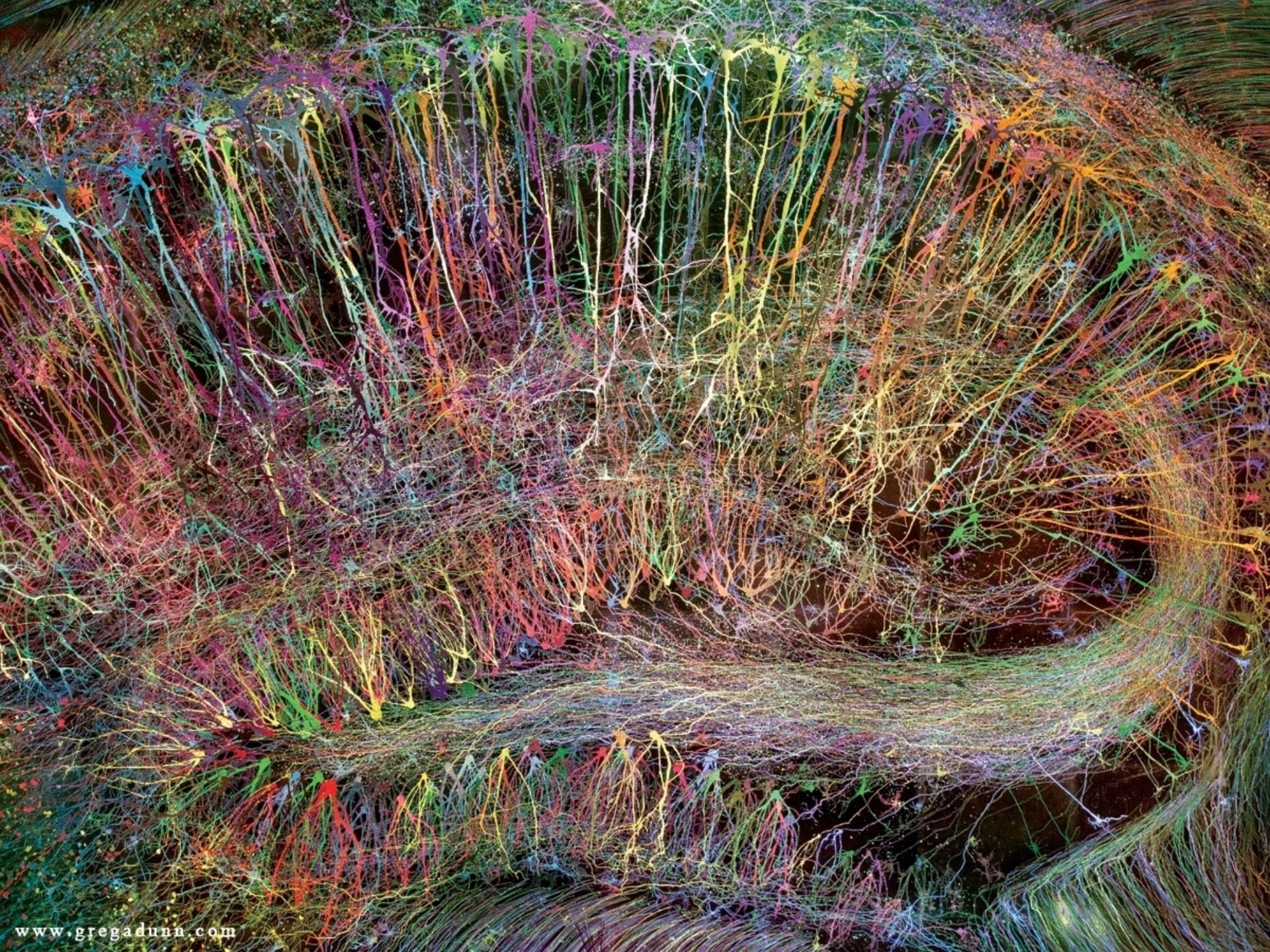
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